

May 1992/\$3.00

Mobile Radio Technology

The Journal of Mobile Radio Technology

DEPT. OF
DODGE COUNTY, WI

Satellite paging signals, p. 10

Technician certification

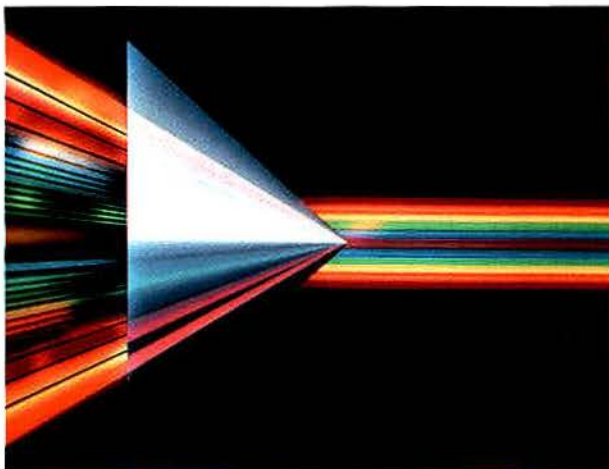
Packet radio RF modem

HF SSB radio

IMCE Wrap-up

Maintaining NiCd batteries

Superior RF site management: we focus on advanced technology so you can focus on advanced profitability.



Antenna Specialists® supports your communications system with a full spectrum of 800 MHz and UHF site management products. Our unique advanced designs will minimize space requirements, antenna investment and service . . . while maximizing reliability, performance and ROI.

A/S 800 MHz transmitter combiners for cellular, trunked and conventional systems. Our high-Q, shared-wall waveguide cavities are made of copper plated INVAR® for exceptional selectivity and temperature stability — and save up to 70% in rack space. The **modular design** permits easy, economical expansion as your system grows. Signal loss is drastically reduced and connector noise entirely eliminated by **stripline output connection technology**.

Equally advanced 4 or 6 channel UHF and high-performance hybrid combiners also available.

A/S duplexers and diplexers. State-of-the-art devices that provide extremely efficient operation of several multi-coupled and combined systems with a single antenna. High-power, 800 MHz designs for cellular, trunked or conventional systems are extremely compact, feature a **patented collinear feed system** for lowest possible loss and maximum Tx-Rx isolation. Our UHF bandpass-bandreject design provides **very low insertion loss** (typically 0.8 dB or less) and superior isolation, in excess of 110 dB. **Unique "fingertip tuning"** permits exact frequency settings without tools. All employ noise-eliminating **stripline connection technology**.

A/S 800 MHz receiver multicouplers. For cellular, trunked or conventional applications, A/S advanced design offers **stripline power dividers** for lowest output loss and maximum Tx-Rx isolation. **Interdigital pre-selectors** provide lowest filter loss and highest isolation for maximum performance.

High-quality, system-designed bandpass filters, precision-engineered isolators and RF loads from 25 MHz to 1 GHz also available.

INVAR® is a registered trademark of the Carpenter Technology Corporation.



the antenna specialists co.

a Member of The Allen Group Inc.

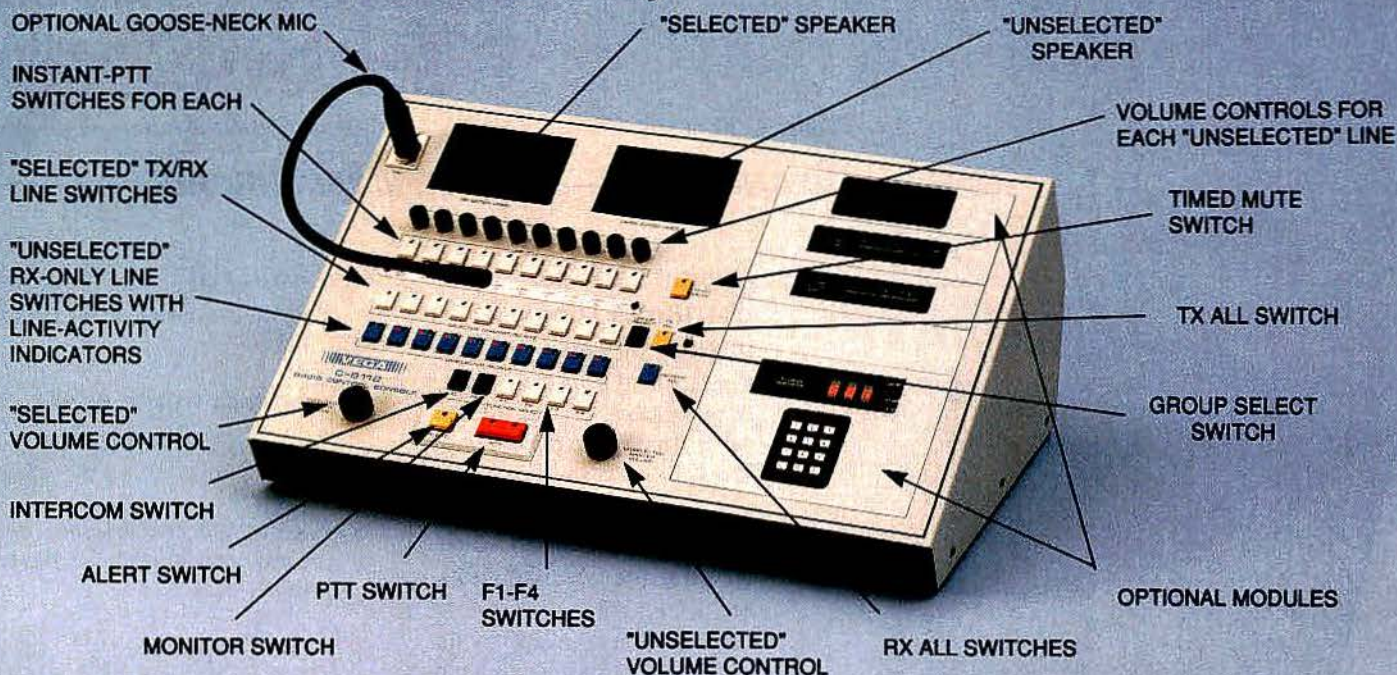
30500 Bruce Industrial Parkway
Cleveland, OH 44139-3996

TEL: 216/349-8400 • FAX: 216/349-8407



® "Stripes of Quality"

More Console, Less \$\$\$



C-5112

Customizable features in an economical standard console

Do you need custom console features on a limited budget? Vega's Model C-5112 ten-line/four-frequency console offers the economy of a standard-production tone-format radio control console with the expandability of a custom design. External adapters are also available to convert any of the ten lines to DC control.

Just a few of the standard features (many usually optional even on larger, more expensive consoles), include:

- **"SELECTED" switches** for selecting any combination of lines for transmitting and receiving
- **"UNSELECTED" switches** for monitoring any combination of unselected lines
- **TX ALL (simulcast) switch** (selects all lines for both transmit and receive)
- **RX ALL switch** for monitoring all unselected lines
- **Separate speakers** and volume controls for "selected" (TX/RX) and "unselected" (RX-only) audio
- **GROUP SELECT** switch for easy selection of TX/RX line combinations

- **TIMED MUTE** switch (temporarily mutes "unselected" audio)
- **Separate volume controls** for each receive line
- **Instant-PTT switches** for each line
- **Line-activity LEDs** (indicate activity on each line, selected or not)
- **Panel-mounting option modules** (interchangeable options)
- **Heavy-duty 120/240-V_{ac} power supply** (also runs on 12 V_{dc})

Options

When you need just a few custom capabilities in a console, you don't have to buy an expensive, fully customizable design. With the C-5112 you can choose just what you need from the following list of economical options and "FX Series" function expansion modules:

- **DCA-3 external three-line adapter** for DC-format lines
- **Audio-level display** and 12/24-hour clock modules

- **DTMF encoder module** with 16-button pad
- **Two-tone, five-tone, and Reach-format sequential encoder** modules with pad and display
- **Function-tone-generator module;** adds eight "wild-card" function tones
- **Cross mute with display module**
- **Goose-neck and desk microphones, headsets, footswitch, etc.**

Future options are planned to include a cross-patch module, phone-patch module, telephone module, and ANI display. Other very specialized modules and options are available at reasonable prices. Consult Vega's Specials Department. Call **1-800-877-1771** (toll-free) today for full details on the C-5112 console.

Circle (4) on Fast Fact Card



a **MARK IV** company

Signaling Products Group

9900 Baldwin Place • El Monte, CA 91731-2204
(818) 442-0782 • 800-877-1771
Fax: (818) 444-1342

features

11 Orbital satellite distributes simulcast paging signals

Norman Gillaspie

Paging systems use satellite signal distribution to replace wireline and terrestrial links.

20 FCC deregulation and technician certification

Al Rodney, CET

Employers who want to use technician certification as a prequalification for new hires may choose from many programs.

26 Packet radio serves library bookmobile

Lynn Melton and Ed Emmel

Modems designed for two-way radio communications applications serve an Idaho public library bookmobile.

34 HF SSB radio bolsters emergency communications

Don Bishop

Companies prepare for potential interruptions of normal communications.

42 IMCE/Spring wrap-up/review

Educational sessions offered some of the highlights from the IMCE trade show in Las Vegas.

46 How to maintain NiCd batteries

Isidor Buchmann

Regular exercise for NiCd batteries extends their service life.

departments

4 Editorial

SMR interference and competition.

6 Letters to the editor

220MHz technologies.

54 News

Kustom Electronics and Coded Communications ink a data terminal deal.

56 ACT update

The benefits of belonging.

57 Regulating technology

Competitive pressure spawns unlicensed operation.

62 New products

Ace Communications, Trilithic and Advanced Electronic Filter are the "Readers' Choice."

69 Literature

70 Feedback

Unlicensed operation haunts marine radio.

71 People

72 Calendar

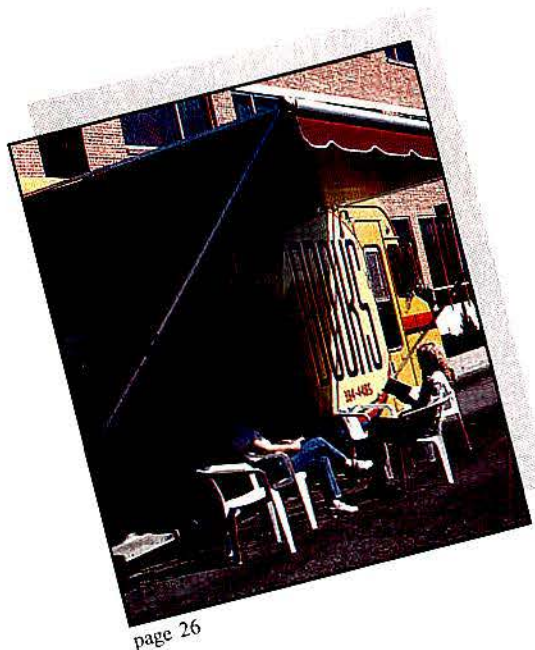
73 Classified ads

88 Ad index/hot line

Find advertisers quickly.

89 What do you think?

Are frequencies too crowded?



page 26



page 34

On the cover: At the ISS Engineering and PageSat control facility in Mountain View, CA, this antenna uplinks paging signals to a satellite for distribution. Photo by Jan Alexander. See article on page 11.

©1992 Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9800 Metcalf, Overland Park, KS 66212-2215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66282-2960.

The New STABILOCK® 4015 Radio Test Set Tests Great—Less Weight

Under
\$13K/3 Year
Warranty

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

The STABILOCK 4015 packs a lot of features in a compact design:

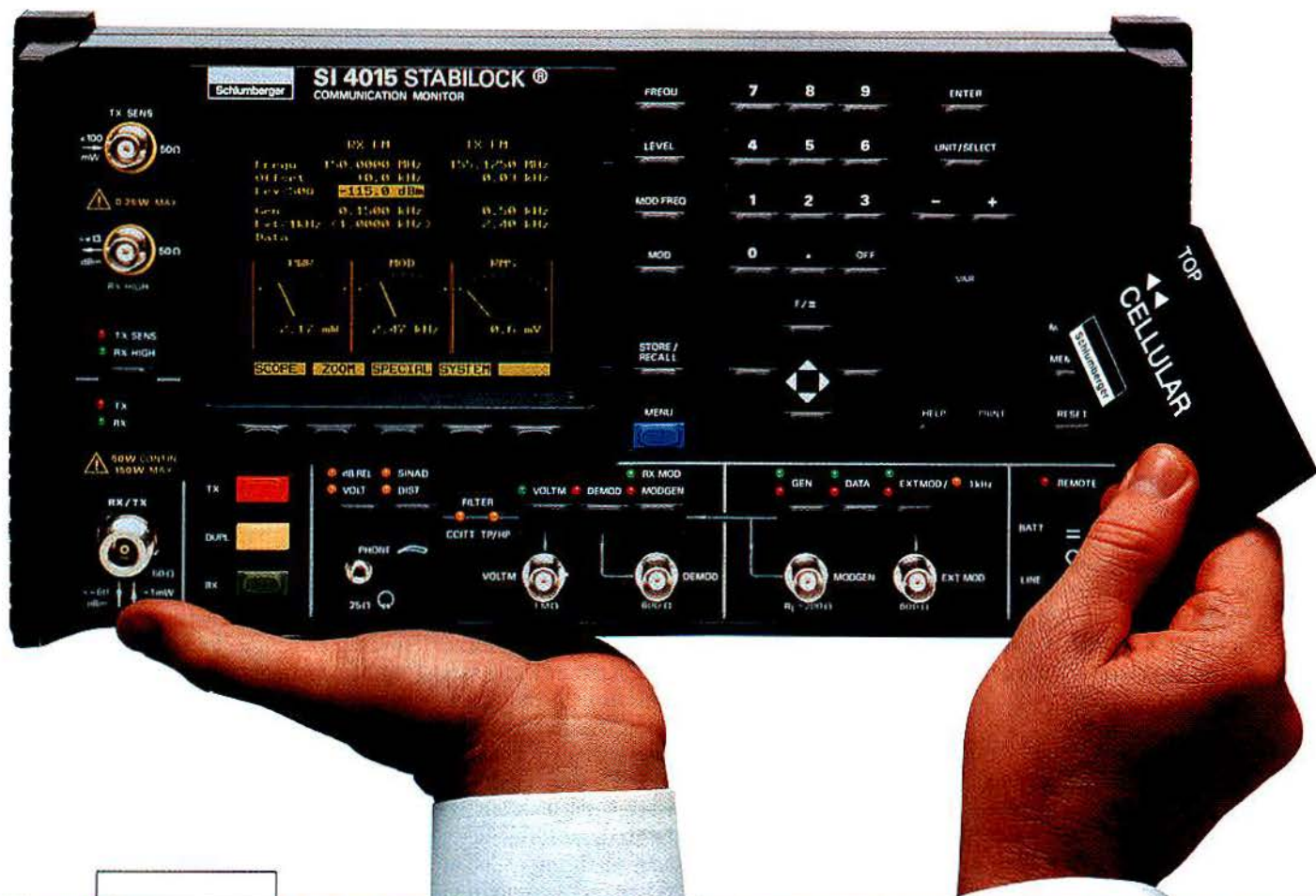
- ☐ spectrum analyzer with audio
- ☐ electroluminescent display for easy viewing night or day
- ☐ licensed CLEAR CHANNEL LTR® testing capability
- ☐ memory cards to load and run tests automatically, including all cellular formats
- ☐ digital storage oscilloscope
- ☐ internal battery

Lighten your two-way test load today—call for more information on the STABILOCK 4015:

1-800-225-5765 (in MA: 508-671-9700).

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies.

Quality Test Solutions
Schlumberger Technologies



Schlumberger Technologies

Schlumberger Instruments
PO. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 544433
Fax-44 252 548854
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Ingolstädter Str. 67a
D-8000 München 46
West Germany
Phone-49 89 31889-0
Fax-49 89 31889-160
Telex-5215015 SMG D

Circle (5) on Fast Fact Card

SMR interference and competition



Specialized mobile radio (SMR) system operators may make an issue of radio interference to prevent new operators from coming into their areas.

Conversely, prospective SMR operators may downplay the issue to obtain licenses that let them become competitors.

As a result, the interference issue cuts two ways: blocking competition and fostering it, depending on the point of view.

When SMR operators sell service to customers in the same area, that's competition. When one builds a system on frequencies that prevent another from expanding service, that's another type of competition: getting there first and claiming the territory.

A new radio system may interfere with radio reception on an existing system. The *degree* of interference is debatable.

The existing system's owner may object if signals from the new system can be detected at all, even if communications are unaffected. The new system's owner would be reluctant to call that interference.

Mileage separations

Initially, FCC regulations required a 70-mile separation between SMR base stations using the same frequencies. Not many base station antennas can be placed high enough to cause interference to a system 70 miles away.

But some can. In parts of California, for example, SMR operators put base station antennas on mountaintops high

enough to interfere with systems more than 70 miles away. To put it another way, these base station antennas were high enough to *receive* interference from new systems more than 70 miles away.

To prevent this interference, some SMR operators persuaded the FCC to increase the required separation to 105 miles between these mountaintops and other base stations on the same frequency.

Aside from limiting the interference, the action restricted competition in those areas.

Short-spacing

When SMR frequencies in many areas were filled by systems meeting the mileage separations, some present and would-be SMR operators asked the FCC to allow systems to be built closer together, a procedure known as short-spacing.

To support their requests, they defined interference as a ratio between the existing system's signal strength (the desired signal D) and the proposed system's signal strength (the undesired signal U), the D/U ratio.

They said no interference results where the desired signal is no weaker than 40dBu and the undesired signal is no stronger than 30dBu: a 40dBu/30dBu ratio. (The ratio was plucked from regulations that separate FM broadcast transmitter locations.)

The FCC granted several waiver requests supported by engineering exhibits using the 40/30dBu ratio. Then it received a request to incorporate the ratio into its rules and grant applications for short-spaced facilities without a waiver.

The way an interference ratio works, the bigger the difference between the two numbers (a higher ratio), the farther the new system has to be built from the existing system. Understandably, many system owners wanted a higher ratio.

Some of them asked the FCC to increase the ratio to 40dBu/22dBu. Fewer base stations can be short-spaced at the new ratio, restricting competition and limiting interference.

At an SMR industry meeting on the subject, the audience of current and would-be SMR operators was asked

whether they favored the more liberal or the more conservative ratio. A showing of hands indicated overwhelming support for the 40dBu/22dBu ratio.

The result moved one of the audience members to say: "We've just heard from the *haves*," meaning those with licenses who want to preclude competition.

The FCC has adopted the 40dBu/22dBu ratio for short-spaced SMR base stations at separations as close as 45.98 miles.

Waiver applications based on the 40dBu/30dBu ratio still can be submitted for separations closer than 45.98 miles. As a practical matter, few applications for short-spacing less than 46 miles are likely to qualify. To qualify, the proposed and existing stations virtually would have to be in valleys on opposite sides of a mountain. Most existing base stations are placed as high as possible, not in valleys.

Historical pattern

Short-spacing SMR base stations follows a historical pattern. Spacings among AM broadcast and non-commercial FM station transmitter locations are limited by D/U signal ratios.

Many broadcasters' complaints about AM radio interference stem from a low D/U signal ratio.

The majority of commercial FM broadcasters apparently favors mileage separations and has succeeded in blocking proposals for short-spacing based on D/U signal ratios. They point to AM radio interference as evidence of what could happen.

Now short-spacing has come to SMR, and time will tell whether the industry and the public benefit.

As one of the participants at the short-spacing meeting told the audience: "Other operators are going to be short-spacing to your systems, and you are going to be short-spacing to theirs. You might as well learn how to do it, even if you never learn to like it."

—Don Bishop

NEW TECHNOLOGY FOR TODAY'S RADIOS

Nobody Scrambles Better

Customers in 55 countries agree that *CryptoVoice Plus*™ technology makes all the difference in the world.

No other encryption outperforms the range, voice clarity or capabilities of our *CryptoVoice Plus*™ III technology.

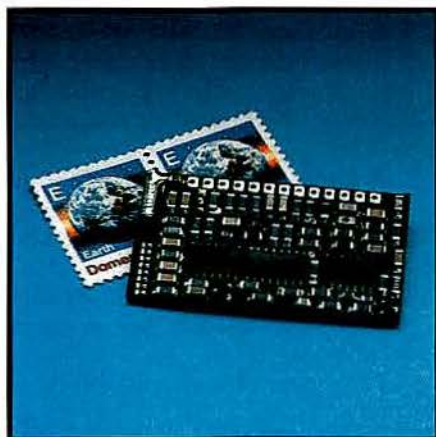
CVP combines digital and analog technologies to outperform plain digital systems.

CVP is universally compatible for mixing various radio makes and models, old or new. And it is designed to fit the smallest handheld systems at a very affordable price.

Crypto Voice Plus is available in medium, advanced and high-level privacy for superior scrambling or scrambling-with-signaling capabilities.

And CVP scramblers can be installed easily in mobile, portable and base units without sacrificing features or performance.

Encrypt your two-way fleet with *Crypto Voice Plus*™ from Transcript. Nobody scrambles better!



SC-20 460 CVP™ III
Over 100 trillion key codes, ANI, EMERGENCY, *stun* and more.

CVP III does more for Motorola than any other system available today.

Special adaptations of the SC 20-460 have been developed for the Motorola *P200*, *GP300*, *HT600*, *MT1000* and *Saber* digital and non-digital radios.

Your Motorola radio or fleet can have all the *capabilities*, *versatility* and *performance* of CVP plus *FlashCall* digital signaling.

SC 20-460 CVP III and its variants provide *Automatic Number Identification (ANI)*, *Selective Calling*, *Over-the-Air Control* and *EMERGENCY*.

Our 460 series modules are compatible with all types of radios and systems. Other system elements available include:

T-CAD, Computer Aided Dispatch software, and TR 30-3200 series Display Consoles.

Enhance your Motorola with CVP III. Engineered for more privacy and performance - and for more Motorolas.



**CVP III
NOW
AVAILABLE
FOR
GP-300**



Transcript / International, LTD.
1620 North 20th Street
Lincoln, NE 68503
(402) 435-4400 Fax: (402) 435-6780

To Order CALL TOLL FREE (800) 228-0226 - Most orders shipped within 48 hours

220MHz technologies:

Thank you for pointing out some of the challenges radio designers face as a result of the new 220MHz band's 5kHz channel spacing requirement ("Editorial," January 1992 issue).

I was disappointed that none of the new technologies mentioned was inherently digital. I cannot blame you for this omission because all of the public relations information distributed by the radio communications industry so far has involved amplitude companded single-sideband (ACSSB) and its variants.

I am writing to tell you what we are doing and the market and technical assumptions on which our work is based.

In the industry, we tend to focus on the supply side, for example, the long waiting lists for specialized mobile radio (SMR) channels in most markets.

Nevertheless, from the user's point of view—the demand side—there exists an adequate, if not abundant, supply of spectrum alternatives (with only a few

exceptions) for good-quality voice communications. See, for example, page 72 of the January 1992 issue: "NABER Asks FCC To Extend SMR Loading Deadlines."

If you were a user needing voice communications, would you buy one of the existing alternatives or one of the new alternatives that is likely to offer sub-standard voice quality transmission in the 220MHz band?

A close look at the FCC rules shows that although 220MHz spectrum is available for several classes of users, this band primarily is for big systems that resemble SMR and private carrier systems.

A glance at the list of applicants for individual licenses shows that many applicants intend to construct a nationwide system, either by using frequencies assigned for nationwide use or by using multiple five-channels systems pieced together city by city.

The matter of standards will be re-

solved by the big users.

By the way, many of the big users desperately want this spectrum for mobile data communications.

The 220MHz band has excellent signal propagation characteristics, including relatively long range communication and relatively low multipath signal fading. These characteristics make the band an excellent choice for data communications, as opposed to the 900MHz band.

Our research shows that the 5kHz channels at 220MHz may outperform the 12.5kHz channels at 900MHz on a data-throughput-per-system, cost-per-square-mile basis.

The trend in the mobile communications industry has been, and therefore is likely to continue to be, toward systems that provide *robust* mobile data communications.

For this reason, research and development money may be better spent on finding ways to use this new frequency

Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, *Editorial Director*
Jane Bryant, *Staff Editor*
Nancy Campbell, *Associate Editor*
Dawn Stilling, *Graphic Designer*
Jeri Robinson, *Paste-up Artist*

INDUSTRY CONSULTANT

Fred M. Link

REGULATORY CONSULTANT

Alan S. Tilles, Esq., *Partner; Meyer, Fallor, Weisman & Rosenberg P.C., Washington, DC*

EDITORIAL ADVISORY BOARD

Gene A. Buzzl, *President, Omnicom Telecommunications Engineering, Tallahassee, FL*
R. James Evans, *Communications Consultant, East Lansing, MI*
Gary David Gray, P.E., *Chief Telecommunications Engineer, Orange County Communications, Orange, CA*
Frederick G. Griffin, P.E., *President, Frederick G. Griffin P.C., Lynchburg, VA*
S.R. McConoughey, P.E., *Mobile Communications Consulting, Gaithersburg, MD*
Art McDole, *Salinas, CA*
F. Stuart Meyer, *Land Mobile Consultant, Vienna, VA*
Don R. Precure, *New Smyrna Beach, FL*
Herb Sachs, *Herb Sachs Consulting, Bowie, MD*

Leon Spencer, *Radio Engineering Systems, Exxon Company USA, Houston, TX*
Dr. Gregory M. Stone, *Vice President, Special Projects, Live Oak Systems, McLean, VA*
Raymond C. Trott, *President, Raymond C. Trott Consulting Engineers, Irving, TX*

BUSINESS

Cameron Bishop, *Group Vice President*
Mercy Contreras, *Publisher*
Darren Sextro, *Marketing Director*
Evelyn Hornaday, *Promotions Manager*
Margaret Sullivan, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Mary Birnbaum, *Advertising Production Supervisor*
Liz Turner, *Advertising Coordinator*
Lisa Cunningham, *Classified Advertising Coordinator*
Tom Cook, *Group Senior Managing Editor*
Czardana Inan, *Group Director of Special Projects*

ADMINISTRATION

R.J. Hancock, *President*
Sandra Stewart, *Corporate Circulation Director*
Cindy Cardinal, *Circulation Director*
Christine Lotesto, *Circulation Manager*
Customer Service, (913) 541-6628

ADVERTISING: Northeast: Ruth Breashears, 303-762-1249; West Coast: Dennis Hegg, 415-491-1442; South: Diane Hite, 303-762-1249; Midwest: Nancy F. Matthews, 312-435-2340; Classified: Carla Gamino, 303-762-1249.

CORRESPONDENCE: Editorial and advertising correspondence should be addressed to P. O. Box 12901, Overland Park, KS 66282-2901, 913-888-4664, telex: 42-4156 INTERTEC OLPK, fax: 913-541-6697.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' representatives, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are responsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; in Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription. Send subscription information to: P.O. Box 12968, Overland Park, KS 66282-2968.

PHOTOCOPY RIGHTS: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of \$2 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01980.

BPA ABP \$3.00 + 0.00
Audited circulation.

INTERTEC PUBLISHING

©1992 by Intertec Publishing.
All rights reserved.

Here's the most
comprehensive line
in cellular
test equipment...

And it's free!

1-800-245-6356



Model AC1
Antenna Coupler



Model CT400
SWR & Field Strength Meter



Model CT2500
*Cellular Tester/Simulator
Communications Service Monitor*



Model CT3500
Cell Site Simulator

Got cellular telephone testing requirements? Need simple but comprehensive solutions? It's as easy as dialing the phone. Dial Wavetek. We offer a full range of testing solutions. One of our product specialists can help determine the best Wavetek model for your needs. And all you have to do is dial 1-800-245-6356. It could be the most cost effective call you will make. For free.

WAVETEK

5808 Churchman Bypass • Indianapolis, IN 46203-6109 • 317-788-9351 • 1-800-245-6356
Telex: 217124 • Fax: (317) 782-4607

Circle (7) on Fast Fact Card

Letters to the editor

band to transmit data efficiently than on trying to get voice communication to fit into the small-bandwidth channels and still sound good.

Based on the above assumptions and a few other assumptions I would rather keep to myself for now, my company is designing a 220MHz radio that employs true digital modulation of the RF carrier.

There are several advantages to digital modulation:

(1) Inexpensive transceiver designs are possible, for example, as in the case with Class C power amplifiers used for FM.

In the same way that FM is a constant-envelope type of modulation, digital modulation techniques exist that are constant envelope. The use of

constant-envelope digital modulation is the chosen path of the cellular mobile telephone industry as it converts from analog to digital.

By contrast, modulation based on variants of AM require expensive linear amplifiers and receivers.

(2) Although an absolute number is not yet available, it is clear that the marriage of a packet radio modem and an analog 200MHz radio will result in an unacceptable data throughput.

Currently, the rule of thumb for a 25kHz channel is 9,600 baud, and for a 12.5kHz channel, it is 4,800 baud. These figures translate to about 1,900 baud for a 220MHz system, assuming the carrier-to-noise advantages of FM systems.

Analog systems based on AM variants are likely to be even less robust for data communications.

On the other hand, our research has shown that between 6,000 baud and 8,000 baud is possible with digital modulation that meets the FCC emission mask for the 5kHz-wide channels.

(3) Should my assumption about the need for voice communications prove false, many good-sounding digital voice compression schemes now exist.

I am sure many 220MHz users will purchase analog voice radio equipment, given the number of manufacturers that are likely to offer products. Nonetheless, radios based on digital modulation technology provide the best chance of realizing the degree of spectrum efficiency the FCC had in mind when it reallocated the 220MHz band for land mobile radio service.

Gary T. Cromack
President

Network Systems Division
Cromack Industries
Greenfield, MA

From Fast Fact Cards:

The two toughest problems facing me on the job are:

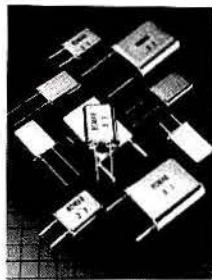
- finding the money to buy new equipment and to keep up with new technology.
- competing with low-end equipment and part-time, no-overhead dealers.

Jeff Domer

Domer Communication
North Canton, OH



"Paging Bomar Crystals!"



Bomar answers your call for excellence with high performance crystals designed for today's leading tone/voice and digital/numeric pagers. Our rugged pager crystals are engineered to deliver superior performance. Performance that comes from over twenty-five years of experience. And performance backed by a lifetime guarantee. Call now for page after page of useful information about our quality products...delivered to you on the double!

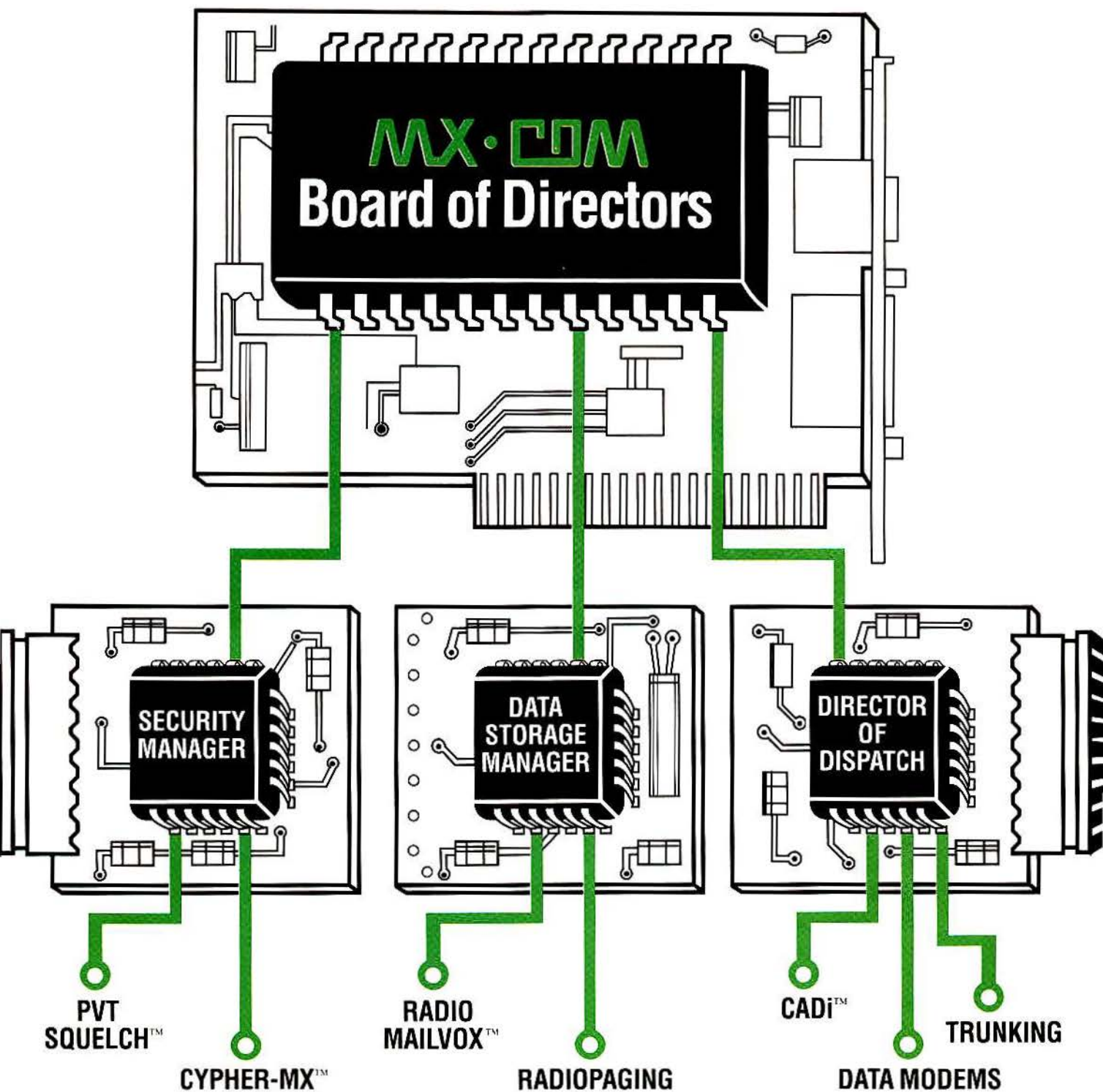
BOMAR

201 Blackford Avenue, Middlesex, N.J. 08846

CALL TOLL FREE
1-800-526-3935

FAX TOLL FREE
1-800-777-2197

Circle (8) on Fast Fact Card



Meet the MX•COM radio channel management team of mixed mode analog/digital IC's and SMT modules dedicated to efficient control of your 2-way radio communications system.

To receive a detailed data resume on one of our radio channel managers **Call Toll Free:**
1-800-638-5577

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054

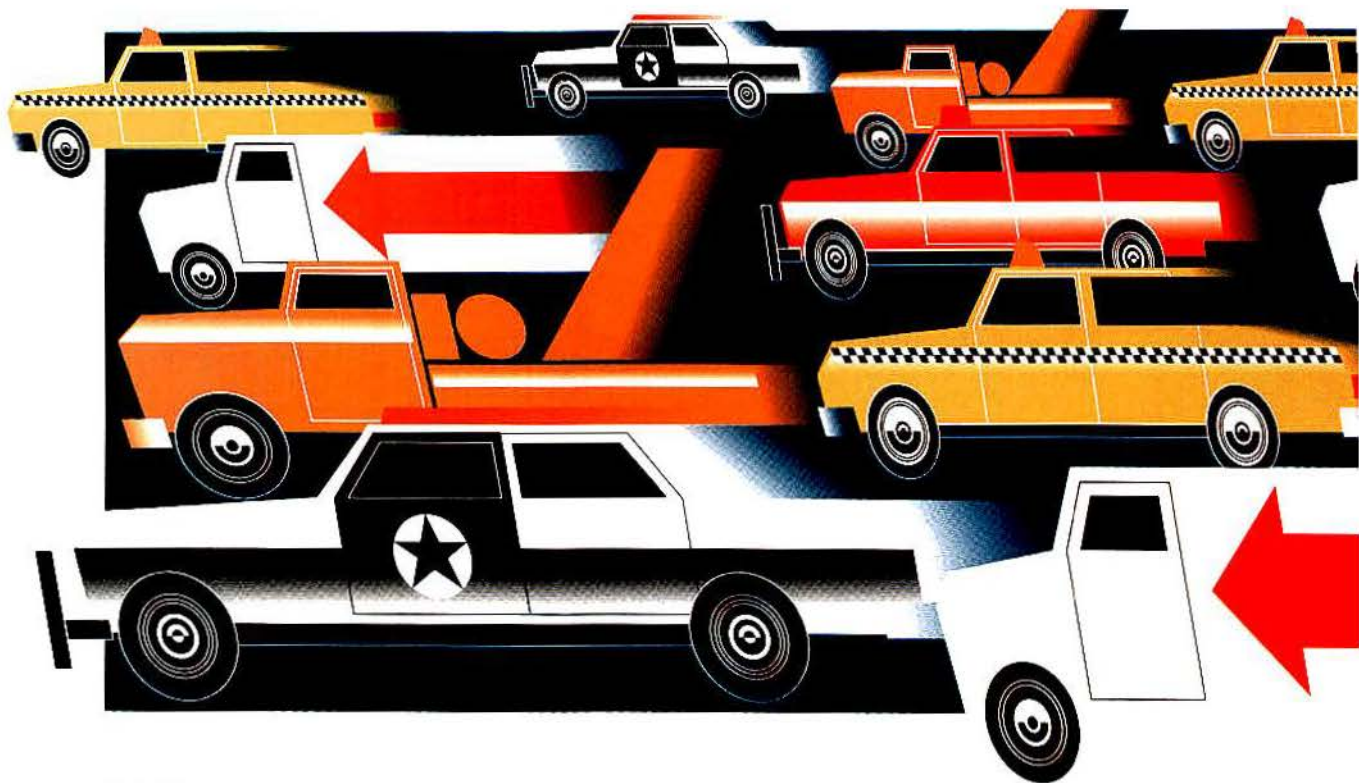
In Canada Call Omni Provincial Electronic, Inc.:

East / 514-648-8432 • Central / 416-841-6740 • West / 403-291-9639 or 604-589-3822

MX•COM, INC.

Circle (9) on Fast Fact Card

Keeping data on the move



Coded knows mobile data communications.

Mobile data users are demanding. They want data quickly and accurately, and they want a mobile data system that will adapt to any kind of computer aided dispatch, mobile data terminal, mobile computer terminal, laptop, or automatic vehicle location system. Lucky for them Coded has years of experience with public safety, taxi, courier, and utility fleets. Coded specializes in ANI products and wireless data network systems that can speed your data along, no matter what color your car is.

Coded Communications

Keeping data on the move

2375 Camino Vida Roble
Carlsbad, CA 92009
(800) 228-6367
(619) 431-0077 Local
(619) 431-1372 Fax

Orbital satellite distributes simulcast paging signals

Paging systems use satellite control signal distribution to replace wireline and terrestrial radio links. Satellite distribution improves simulcast performance and makes construction and expansion easier.

By Norman Gillaspie

Optimal national and regional satellite delivery system design, especially for simulcasting, solves technical and logistical problems that alternative satellite, wireline and radio control link methods cannot remedy.

How paging systems work

Typical paging systems receive messages via direct inward dialing (DID) lines from customers. The paging management system's database verifies message numbers. Then they are encoded with forward error-correction (FEC) and prefaced with an addressing header. FEC allows reliable decoding even

when a received message contains one or two errors.

Encoded messages are sent via a telephone line or terrestrial radio link to multiple paging sites. At the paging sites, messages are received as audio frequency-shift keying (FSK) tones interspersed with tones that control the paging transmitter. Occasionally, paging traffic halts while Morse code station identification is transmitted.

Most paging traffic relies on terrestrial transmission via telephone lines or radio. Both methods have serious limitations.

► **Telephone lines**—Distributing paging messages via telephone lines incurs monthly costs. System expansion increases operating expenses because the more base stations and the greater the distance from the terminal, the higher the cost.

Moreover, line quality is subject to change with weather and the maintenance and replacement of telephone company equipment. Line quality variations can cause simulcast performance to deteriorate.

► **Terrestrial radio links**—Paging distribution systems that rely on radio links may be compromised by the shortage of suitable link frequencies, and therefore the potential for system expansion may be limited. Adjacent channel interference can occur when radio frequencies are too close, and the transmission time may be slowed when frequencies are shared.

Geographic features may restrict site selection options for point-to-multipoint signal distribution. These geographic limitations become increasingly important as system coverage grows to regional and national proportions.



The ISS Engineering and PageSat control facility in Mountain View, CA, uplinks paging signals to a satellite for distribution.



A satellite downlink antenna mounted at a paging transmitter tower site.

In addition to link equipment costs, payments must be made for antenna space and electrical power at transmitter sites, for license application and renewal, for legal fees and for maintenance.

National paging distribution

To achieve national paging coverage, in the early 1980s satellite delivery of paging traffic was introduced. In a typical satellite delivery system, time-division multiplexing (TDM) and FEC combine paging data at the terminal. The resulting paging signal is upconverted to a microwave frequency and beamed to the satellite.

At the paging downlink site, the signal is demultiplexed, fed to the regional paging management system and then distributed via a master link transmitter to multiple receive sites equipped with link receivers. Receiver output drives the base station transmitters.

The major drawback is that a regional paging management system outage interrupts service to an entire market.

Furthermore, this method adds another

level of complexity and transmission costs without eliminating any equipment costs. Only large paging companies can afford high monthly fees for conventional satellite delivery.

Improved design

An improved satellite paging system design seamlessly integrates existing paging technology with satellite capability. It accounts for the link margin:

The paging signal is delivered to downlinks at each paging transmitter...

potential outages due to rain fade; signal transparency; satellite power; dish size; and the simulcast paging system's technical requirements.

The potential for uplink fade incidents

can be reduced by placing the master uplink at a California location that has mild rain rates. If the uplink is in the same location as the downlinks, the same weather system has the potential to attenuate the signal twice.

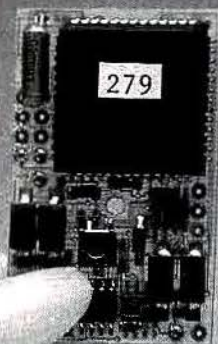
The paging signal is delivered to downlinks at each paging transmitter, so the loss of an individual downlink does not cause a regional outage. Most likely, only a single base station would be affected.

The larger the receive antenna and the greater the satellite's power, the larger the link margin. With 0.75-meter receiving antennas and in 80% of the U.S. land area, the improved satellite paging system provides 10dB of rain margin.

Some satellite systems provide only 6dB of rain margin with a 0.75-meter antenna. The improved system achieves a better margin with higher satellite power and an extended-threshold receiver that performs better under poor carrier-to-noise (C/N) ratios than simpler receiver demodulation circuits.

The sun can cause outages, but at

It will put a lid on it.



Digital ANI

Introducing CSC's ID-33 Encoder for Automatic Number Identification—

This state-of-the-art, subminiature ANI board will stop the horseplay and end the stuck mikes. It includes a time-out timer and emergency/status messages as well as ANI; transmits the ID in a mere 100 milliseconds. Fleet prices from \$69 to \$121. Call for brochure.

CSC CONTROL SIGNAL CORPORATION

1985 S. Depew St. #7 Denver, CO 80227 (303) 989-8000

CALL TOLL FREE 1-800-521-2203

Circle (11) on Fast Fact Card

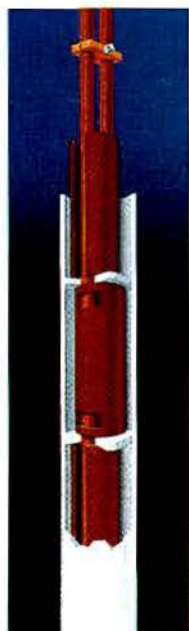


THE PERFECT '10'

You've been wanting a 10 dBd antenna that really delivers 10 dBd all the way across the band. One that covers the entire 806-960 MHz range in 3 bands, allows for duplex cellular operation and has 1500 Watt power capability.

We listened, and now you have one. The Celwave PD10183.

It's the top performing, pattern constant throughout the band, 187 mph wind beating, transposed dipole array, copper radiating elements enclosed in a rigid fiberglass radome, omnidirectional



stroke of genius that won't punch holes in your system.

Whether you mount it upright or invert it, electrically downtilt it or add a directional reflector, anything less than a PD10183 is less than perfect.

CELWAVE 
DIVISION OF RADIO FREQUENCY SYSTEMS

Celwave, Route 79, Marlboro, NJ 07746
(908) 462-1880 • (800) 321-4700

cushcraft/Signals

ANTENNAS WITH THE BEST CONNECTIONS

ULTRALINKTM
C A B L E

THE ORIGINAL ALL BRASS MOUNT

Since 1978, Cushcraft/Signals all-brass mount has been the industry standard.

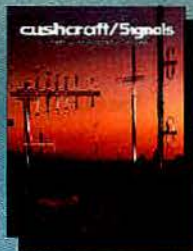
- Non-corroding
- Excellent conductor to ground
- Parts will not seize together
- Easily removed
- Large improved grounding teeth
- Soldered ground lug

UltraLink CABLE

Solves many problems experienced by mobile installers.



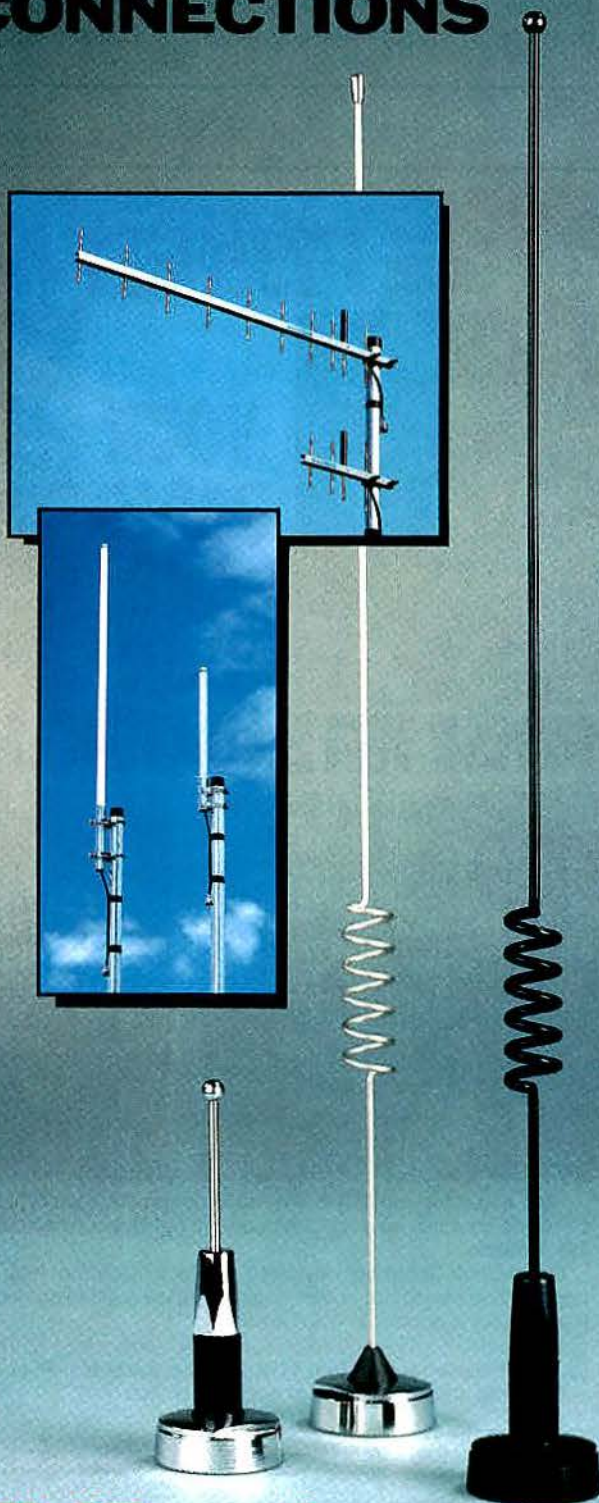
- Low-loss Teflon[®] dielectric
- Withstands high temperature
- Fits standard RG58 size connectors
- Easily removed dual shields
- Used in our base and mobile antennas



New
Catalog

Cushcraft/Signals supplies a complete line of base and mobile antennas. Call us or your favorite distributor for fast delivery or our latest catalog.

1-800-258-3860 • FAX: 1-800-258-3868



cushcraft/Signals

Satellites are power-limited devices. With a smaller earth-based receiving antenna and a less efficient modulation scheme, more satellite power must be used, boosting the monthly space segment costs.

Doubling the satellite power, a power increase of 3dB, increases the space segment cost by 50%. Reducing the power by 3dB reduces the cost by half.

The major cost factors for a given power level, all other conditions being equal, are:

► **Antenna size**—A decrease in antenna size increases the power required for a given performance level. Halving the antenna size increases the space segment cost by a factor of four.

► **Modulation scheme**—The more efficient the modulation, the more com-

plex the receiver must be, increasing the hardware costs.

For instance, FDM-FM-FM uses more power than FDM-FM-SSB or FDM-FM-QAM. The improved satellite paging system uses FDM-FM-SSB, which is more efficient than FDM-FM-FM, a non-standard FM-squared variant.

FDM-FM-FM is frequency-division multiplexing with two levels of frequency modulation. FDM-FM-SSB multiplexes single-sideband modulation on FM signals. FDM-FM-QAM multiplexes quadrature amplitude modulation on FM signals.

► **Rain**—The more frequent and the heavier the rain, the more satellite power needed to maintain a 99.95% or better level of link availability. The lower the receiver threshold, the less power from the satellite is required to achieve 99.95% availability—but the hardware cost increases.

With these trade-offs in mind, the following conclusions can be made:

Bigger antennas run up the initial site costs. Smaller antennas run up the monthly space segment costs.

The more sophisticated the receiver, the higher the initial hardware costs and the lower the space segment and site costs, and the service is more reliable.

With fewer than 15 sites, a paging business can justify a more complex receiving system, allowing lower satellite power requirements and consequently lower space segment costs. Each earth station costs approximately \$2,000.

In some satellite applications where the number of sites exceeds 200, hardware costs become critical. The space segment cost is less important because more power and expense on the satellite allows the use of simpler receivers.

Simulcast paging

► **Phase delay**—In a simulcast system, signals should arrive at each base station simultaneously to avoid the need for delay circuits and other signal processing. By virtue of the satellite being 22,000 miles from the uplink and downlinks, the signal delay caused by distances between paging transmitters with overlapping coverage becomes negligible.

The satellite receiver designed for paging service must meet manufactur-

THE PERFECT MATCH.



**YOUR
RADIO
AND
OUR
NOISE ATTENUATING HEADSET.**



High noise can make two-way radio communication difficult, if not impossible. Combine your two-way radio with one of our Noise Attenuating Headsets to solve this problem.

David Clark Company Headsets combine maximum hearing protection, with comfort and perfect reception. Superior noise-canceling microphones deliver clear transmissions at normal voice levels.

NO RADIO MODIFICATIONS ARE NEEDED.

Choose between hands-free VOX (voice activated) or Push-To-Talk operation.

For more information, call or write.



David Clark COMPANY
INCORPORATED

360 Franklin St., Box 15054, Worcester, MA 01615-0054 • (508) 756-6216 • Telex: 920482 • FAX: (508) 753-5827

Circle (15) on Fast Fact Card

We interrupt this magazine to bring you some important messages.



EMERGENCY



MAN-DOWN



STUCK-MIC



REQUEST-TO-TALK

C-Mark II single-window
ANI decoder-Display.
List price \$995.

Only the new C-Mark Series of ANI decoders from Cimarron Technologies identify and display unique codes for all these messages.

Plus, we offer you a complete, versatile GE-

Star/STAR compatible ANI system that includes:

- CEU-I sub-miniature ANI encoder.
- C-Mark I decoder-computer interface.
- C-Mark II single-window.
- C-Mark III multi-window.
- Battery-operated, hand-held programmer.
- No-hassle three-year warranty on materials and workmanship.



CEU-I ANI encoder.
List price \$86.



Battery-operated
hand-held programmer.

Find out more about the quality, economical new solution that gives you all the advantages of ANI and a whole lot more. Contact your mobile radio dealer or Jack Batchie, Sales Manager, Cimarron Technologies,

934 S. Andreasen
Drive, Suite G,
Escondido, CA
92029-1919,
1-800-487-7184
in USA and
California. Or call
(619)738-3280.



C-Mark III multi-window
ANI decoder-display.

CIMARRON TECHNOLOGIES

GE-STAR is a registered trademark of General Electric Corporation.

ing standards for long-term reliability and temperature variations.

For example, the bit width of received digital signals should not vary with time and temperature changes. Transport delay through satellite receivers should be the same or should have adjustable delays to match system timing. Tolerances for changes in transport delay and bit width become narrower as data rates rise above 2,400bps.

The latest generation of receivers uses digital signal processing (DSP) to filter and demodulate signals, and to prevent changes in transport delay.

Digital or analog outputs

A satellite receiver that incorporates both digital and analog outputs is available. The receiver has an RS-232 output in addition to an analog output, which allows paging operators to switch between digital and analog operation.

The digital output is configured for 1,200bps or 2,400bps for use with digital paging transmitters and transmitter controllers. With this option, paging

Specific geographical areas can be served independently...

companies can expand their coverage by adding new digital transmitters into an existing analog keyed system.

► **Frequency control**—Frequency error caused by base station RF reference oscillator aging is a problem in a simulcast system.

A solution is the transmission of a reference signal from a common, ageless, high-stability source via the satellite to each base station. At the base station, a reference decoder provides a source of low-phase noise, 5MHz or 10MHz signals.

The reference signal can be used alone or with the base station's high-stability oscillator as backup.

The elimination of adjustments allows

for more and smaller base stations to increase fill-in coverage of marginal areas.

Affordability

By eliminating frequency coordination problems and by facilitating speedy construction of new and expanded paging systems, the satellite delivery system should be affordable with as few as 10 sites.

One requirement for affordability is that the satellite receiver be compatible with older technology, such as standard telephone company products and interfaces. This compatibility allows it to connect with existing components at the transmitter site.

The paging signal from the terminal travels through digital fiber line to the uplink facility where it is transmitted to the satellite for multipoint distribution. The satellite offers continental coverage of any number of downlink receive sites.

The system uses analog transmission techniques, but demultiplexing is accomplished by digital signal processing (DSP) to provide the digital reliability together with analog efficiency. The technique is comparable to recording a voice (an analog signal) on a compact disc (CD) and playing it back, using the CD's digital processing and filtering. The combination offers long-term reliability and integrity without the need for adjustment.

It has the capacity to carry high-speed paging signals in RPC1 (formerly POC-SAG), Golay, NEC and two-tone codes and voice.

With satellite coverage of the continental United States (CONUS), single-channel transmission charges for the entire United States are virtually the same as they would be for reaching a small regional or metropolitan area.

Specific geographical areas can be served independently, permitting a type of zone paging similar to long-distance telephone service.

The low cost for a satellite channel, combined with the wide range of coverage, gives paging companies more options for the type of service and billing offered to customers.

The use of satellite technology to distribute paging traffic is proven. The extended reliability, improved service quality and reduced maintenance costs are its major advantages.





Before you order any more portable FM radios, get your hands on this little lifesize brochure.

Midland's brand new line of advanced, ultra-compact, virtually indestructible handhelds may change your plans — and will certainly help your budget. Call today.

1-800-MIDLAND, Ext. 1690
In Canada, call 416-287-2320

- Over 30 models from basic to mega-capable units.
- All meet MIL SPEC 810C/D for shock and vibration.
- Full range of options from external speaker/mics to DTMF (telephone) signaling.
- Intrinsically-safe models.

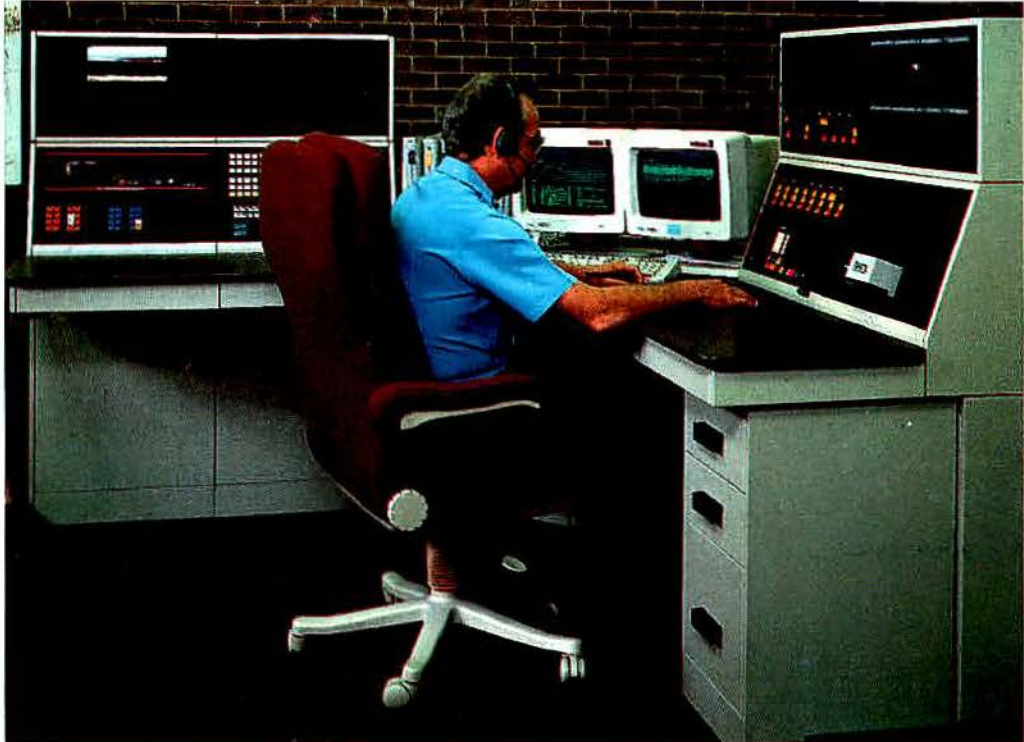
MIDLAND LMR
LAND MOBILE RADIO
the smart way to go



© 1990, Midland International Corporation

Circle (17) on Fast Fact Card

When every second counts...



TDM-150: Our state-of-the-art, 120+ channel console

Count on the reliability and performance of communications consoles from Orbacom

In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbacom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbacom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-

division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



Mini-TDM-150 Desktop Console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbacom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455
and let Orbacom solve your
dispatching problems. Orbacom
Systems, Inc., 1704 Taylors Lane,
Cinnaminson, NJ 08077;
FAX: (609) 829-6980.



Circle (18) on Fast Fact Card

FCC deregulation and technician certification

Employers who want to use technician certification as a prequalification for new hires may choose from many programs. Some select the FCC radiotelephone operator license, although the exam is out of date.

By Al Rodney, CET

Rapidly advancing technology affects everyone: the FCC, the electronics industry, consumers and electronics technicians. Keeping up with developments is difficult. If you service and repair electronic products, you face so many

Rodney holds an FCC license and two technician certificates from the Electronics Technicians Association and the International Society of Certified Electronics Technicians. He works as a technician and administrator, and he lives in Brooklyn, NY.

new challenges to your skills that you probably accept them as inevitable. Remember when transistorized products flooded the market, challenging the skills of technicians who trained on electron-tube equipment? Now such challenges come several times a year!

As radio carved its niche and as television grabbed a foothold, Congress created the FCC to regulate the airwaves. The FCC classified radio stations, prescribed their operators' qualifications and issued station and operator licenses.

FCC rules, in effect, set industry em-

ployment standards by requiring technicians to have a radiotelephone operator license to service transmitters. A technician who passed an FCC examination was "government-certified" to service and maintain some of the most elaborate electronics systems.

For the huge FCC, operator licensing has become a minor function. (See Figure 1 below.) The agency still decides how particular frequencies will be used and sets standards for their use.

In part because solid-state electronic equipment is more reliable than the electron-tube equipment that it has dis-

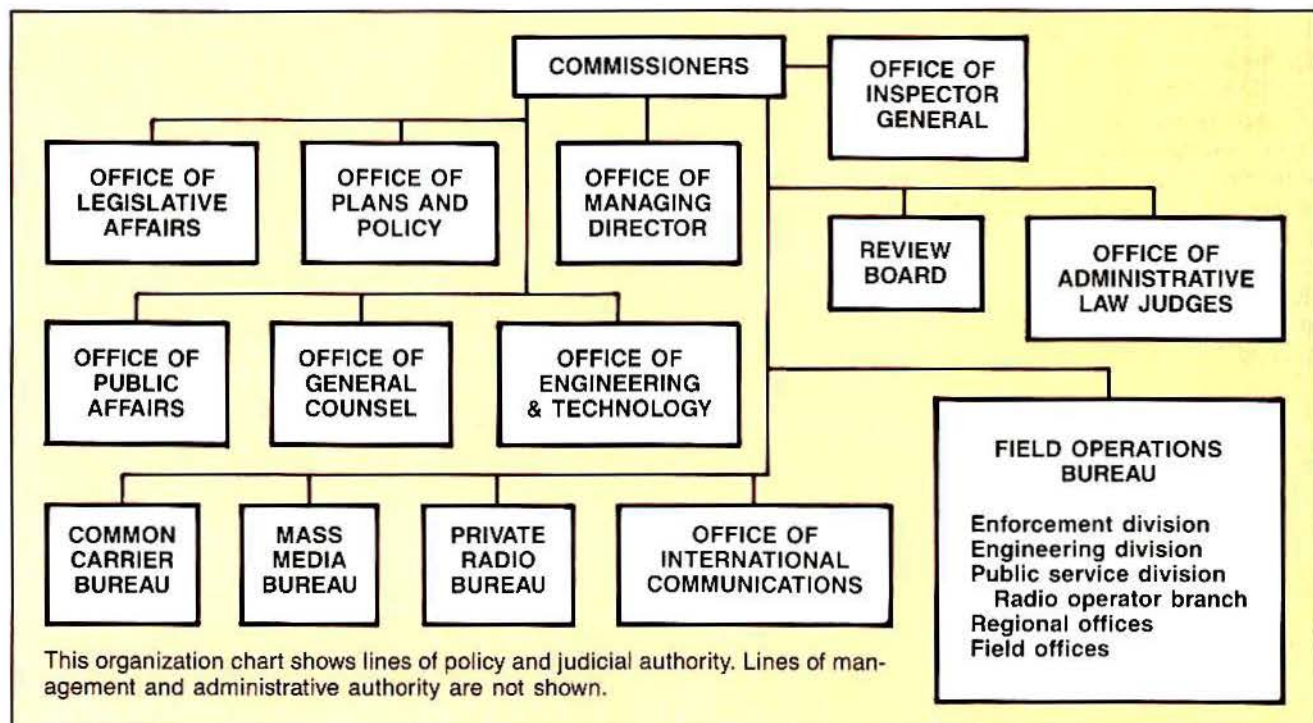
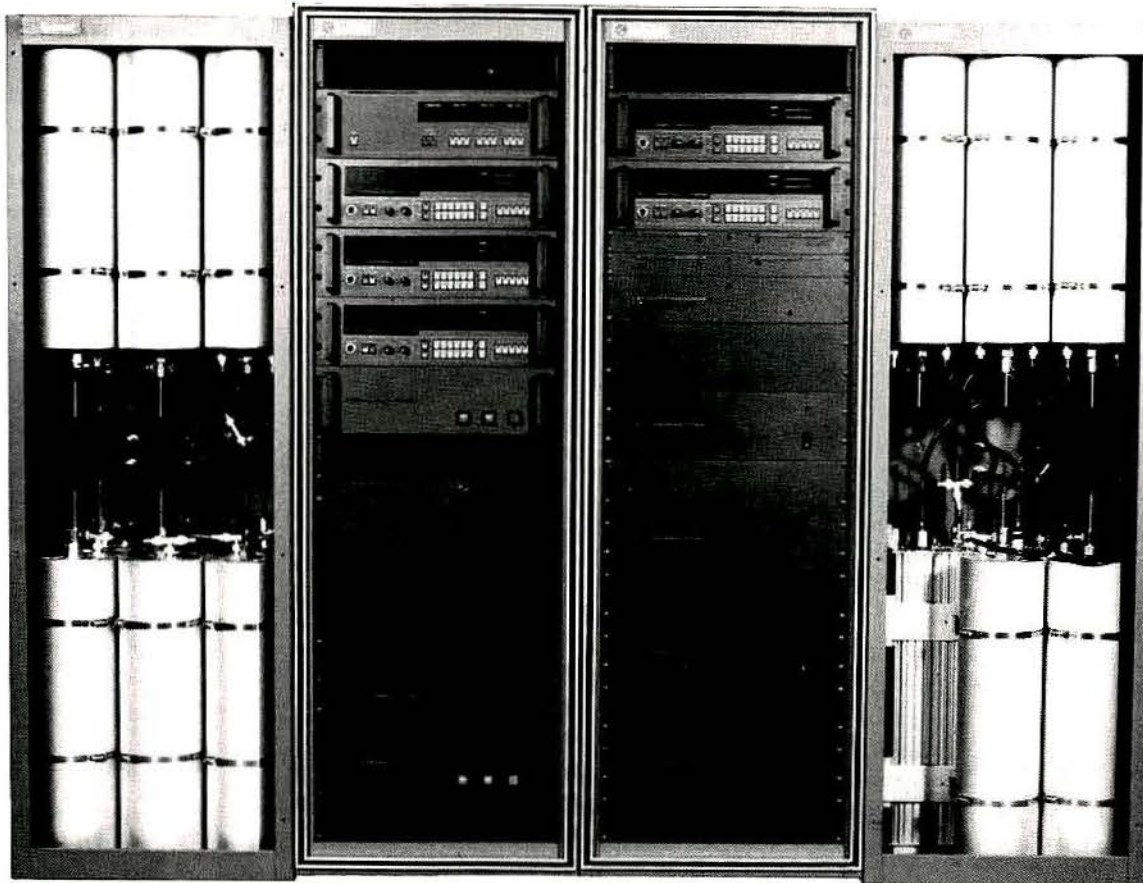


Figure 1. Tucked away in a small corner of a huge Federal Communications Commission, the Radio Operator Branch continues to examine candidates and to issue commercial licenses.

Designed for Reliability



5-channel system with automatic changeover

Let's face it, reliability is critical in your radio system. Your communications are simply too valuable to be lost due to down time. That's why we design our "backbone" systems with the utmost in reliability.

Our ACU-11 and ACU-31 automatic changeover equipment will monitor your base or repeater stations for proper operation. Should anything go wrong, a standby unit will automatically switch in so your communications can continue. All without a trip to the tower site.

Combine the automatic changeover function with the advanced diagnostic and battery back-up features of our KG110 series base and repeater stations, and you'll have a system you can rely on.

We'll be happy to provide a quotation for the radio equipment, or for a complete system from the tip of the antenna to the operator's console. For more information on our high performance base and repeater stations – or any of our communications products – call us today.

CALL US TOLL-FREE AT 1-800-535-2082

Land Mobile Communications Equipment and Systems

Kyodo West, Inc. • 200 Bursca Drive, Suite 100 • Bridgeville, PA 15017 USA • (412) 281-7895 • FAX (412) 221-9518



kyodo west™

placed, the commission decided to stop requiring most radio technicians to have licenses. When a tube was replaced in a transmitter, it had to be checked for proper operation. At one time, technicians replaced many tubes.

The move to modular electronics construction was another factor in the decision. Technicians who serviced electron-tube equipment worked with

discrete components. Technicians who service modern equipment may only have to replace modules, such as integrated circuits and circuit boards, to effect a repair.

According to Electronics Technicians Association (ETA) president Dick Glass, CETsr, "Board changers aren't good technicians. Board *repairers* are." But how can you tell a proficient board

repairer from a skillful board changer? Both are "electronics technicians."

Radio operator licensing deregulation affects a small portion of the telecommunications industry. But it affects most of the radio communications segment, including radio users such as taxi companies; farmers; telephone companies; and public safety agencies. It affects citizens band radios and personal communications devices.

Deregulation primarily affects the fixed and land mobile radio services. The burden of ascertaining a technician's qualifications now rests with the employer. "Technicians no longer are 'prequalified' by the FCC," Glass said.

According to Glass, the FCC radiotelephone operator license remains valuable to the fixed and land mobile radio communications industry. "The FCC license still carries about the same level of influence as before," he said. "The public and the technicians believe it indicates some level of technical expertise."

The FCC license no longer is a legal requirement, which places it on an even footing with industry-sponsored technician certificates. The employer decides what to require.

'Board changers aren't good technicians.'

An FCC radiotelephone operator license indicates some "minimum" level of competence. A technician certified by ETA must offer evidence of experience, training or both before taking the ETA exam.

But most major companies place their confidence in modular electronics equipment. Thus, they do not require new employees to have an FCC license or a technician certificate. Deregulation makes it possible for such companies to hire unqualified technicians at low pay. These technicians are expected to learn what they need to know on the job.

While some companies hire qualified technicians, pay them more and offer them recognition for superior performance, other companies become depen-

Now, a two-way line you can count on.

Count on Mobile Mark to come up with this new, economical two-way antenna: shown with a black/chrome base and a 1/4 wave whip. Available for 140-950 MHz.

It's just one dependable part of our new roof and body mount antenna line that includes UHF, VHF and Low band antennas.

All are engineered for outstanding performance, and backed by solid sales support and warranty.

Count on Mobile Mark for continuing service long after the sale, too. Our 43-year reputation for responsive service is unequalled in the mobile communications industry. Call today.

1

Quick Disconnect Mechanism lets the whip come off easily.

2

Spring Loaded Center Contactor means quality reception that lasts.

3

Neoprene O-Ring Seal effectively keeps moisture out of the connection.

MOBILE MARK
COMMUNICATIONS ANTENNAS

3900-B River Road, Schiller Park, IL 60176 800-648-2800 or 708-671-6690

Circle (20) on Fast Fact Card

FREEMAN ENGINEERING ASSOCIATES, INC.

presents *integrated paging and voice page review* including:

- Analog and Digital Paging
- Trunk Concentration
- Outdial with Call Forwarding
- TNPP Networking
- Redundant Storage
- T-Span and Analog Trunk Compatibility



"Advancing communication through, *the hands of time.*"



3100 Fifth Street, Metairie, Louisiana 70002
Office: (504) 831-7785, Fax: (504) 831-7859, Telex: 9102401822

To find out more please call, write or fax! Your communication needs are important to us!

Circle (21) on Fast Fact Card

Technician certification organizations

Associated Public-Safety Communications Officers

2040 S. Ridgewood Ave.
South Daytona, FL 32119
904-322-2500

Electronics Technicians Association

602 N. Jackson
Greencastle, IN 46135
317-653-8262

International Society of Certified Electronics Technicians

2708 W. Berry St.
Fort Worth, TX 76109

National Institute for Certification in Engineering Technologies

1420 King St.
Alexandria, VA 22314
703-684-2835

National Association of Radio and Telecommunications Engineers

547 Court St., N.E.
Salem, OR 97302
503-581-3336

National Association of Business and Educational Radio

1501 Duke St.
Suite 201
Alexandria, VA 22314
800-759-0300

dent on modular products, simple repair procedures and the reliability of modern electronic devices.

Long before the FCC deregulated operator licensing, the International Society of Certified Electronics Technicians (ISCET) began its certified electronics technician (CET) program in association with the electronics industry's Na-

tional Electronics Association. ISCET offers an "Associate CET" certificate to candidates who pass a basic electronics exam. "Journeyman CET" certificates are awarded to candidates who prove four or more years of experience, training or both; and who pass a more focused examination.

The ETA broke away from ISCET

and adopted a certification program independent of any trade association. It offers CET certificates that include "Associate" and "Journeyman" endorsements. A "Senior-Level" certificate may be earned by a technician who proves eight or more years of experience and who scores 85% or higher on an examination focused on the technician's area of specialization. A "Master-Level" certificate goes to technicians who pass all of the specialized examinations.

Several other organizations certify technicians. They work hard to keep their examinations up to date so they reflect modern technology. But as long as it is not an employment requirement, only self-motivated technicians will obtain certification.

Employers should ask for information from organizations that certify technicians. They may find a program that offers a helpful tool for judging the qualifications of prospective employees. A list of such organizations appears in the box above at the left.

It All Adds Up!

Tomorrow's Technology with Today's Service.

Radius
COMMUNICATIONS

ANDREW

MIDLAND
COMMUNICATIONS



Technophone
CELLULAR PHONES

MIDLAND
COMMUNICATIONS



BARRETT
COMMUNICATIONS
MOBILE MARINE & AERIAL SYSTEMS

JRC
COMMUNICATIONS



BIRD
Electronic Corporation

NEWMAR

▼ **Need it fast? Marketronics' huge inventory levels enable us to ship most items immediately.**

▼ **Need technical assistance? Our trained staff stands ready to assist you.**

▼ **For Low factory prices and the best service in the industry, call us!**

Since 1976 Marketronics has been a leading U.S. supplier of telecommunications equipment to the world. Call and discover the difference.

Call our toll-free order line:

1-800-845-1230



Marketronics
CORPORATION

The Telecommunications Product Specialists

A STOCKING DISTRIBUTOR OF TWO WAY RADIO EQUIPMENT, ANTENNA SYSTEMS, CABLE CONNECTORS, POWER SYSTEMS & ELECTRONIC TEST EQUIPMENT

Circle (22) on Fast Fact Card



"Maxrad Makes the Difference"

MAXRAD's *Nonglass* antennas, unlike glass-mounted antennas, allow a 100% signal transfer to the radiating element with no through glass loss.

MAXRAD offers a complete selection of 3dB or 5dB gain antennas for 800-900 MHz, Cellular and SMR applications. Our elevated feed and 3/4" hole mount antennas are available in black or chrome with various cable and connector options to suit your application.

All MAXRAD state-of-the-art products are now warranted for 2 years.

2495 Pan Am Blvd.
Elk Grove, IL 60007
Voice: (708) 595-3933
Fax: (708) 595-3951
Order: (800) 323-9122

MAXRAD[®]
State of the Art Antennas

MAXRAD Products Are Represented By:

ASSOCIATED SYSTEMS

(603) 472-2297
Territory Covered: CT, ME, MA, NH, RI, VT

AURORA MARKETING CO.

(303) 758-3051
Territory Covered: CO, WY, UT, Eastern MT, Eastern ID, NM

BILL BROWN COMPANY

(404) 939-7075/1395
Territory Covered: AL, AR, DE, DC, FL, GA, LA, MD, MS,
Southern NJ, NC, Eastern PA, SC, TN, VA, WV

HAROLD J. CURRY SALES CO., INC.

(913) 381-1013
Territory Covered: Southern IL, IA, KS, MO, NE

KENNEDY ENGINEERING

(213) 690-8090
Territory Covered: AZ, CA, NV

MANON ENGINEERING

(206) 827-7449
Territory Covered: AK, HI, Western ID, Western MT, OR,
WA, Pacific Trust Territories

MELBY COMMUNICATIONS

(612) 884-7688
Territory Covered: MN, ND, SD, Western WI

R.F. MARKETING

(317) 849-8662
Territory Covered: Northern IL, IN, KY, MD, MI, Western PA
WV, Eastern WI, OH

D. W. SCOTT ASSOCIATES

(713) 351-7420
Territory Covered: TX, OK

SIGMA MARKETING

(203) 531-5115
Territory Covered: New York City & Northern NJ



Circle (23) on Fast Fact Card

Packet radio serves library bookmobile

Modems designed for two-way radio communications applications serve an Idaho public library bookmobile. The system makes maximum use of previously installed facilities to reduce costs.

By Lynn Melton
and Ed Emmel

Integrated, compact radio modems make point-to-multipoint mobile digital data transmission readily available and affordable. For example, the city of Boise, ID, public library installed a radio telemetry system to transceive library subscriber information between the centrally located main library in town and a mobile "library on wheels" that travels to remote sections of the city.

The communications system's RF segment consists of ESTeem model 86 UHF packet radio modems at the main library; at a hilltop radio repeater that overlooks the city; and in the bookmobile. The packet radio modems are made by Electronic Systems Technology, Kennewick, WA. A central computer at the library executes an automated library application program to control the entire operation.

The city's equipment services superintendent, Kent R. Greenwell, explained: "We wanted a radio system that we could integrate easily into our existing bookmobile and mainframe computer. It must operate transparently with our existing software. That's exactly what we got."

The bookmobile modem forms an interface between a Wyse data terminal with RS-232 output and the mobile radio transceiver. As library patrons make their requests, the bookmobile operator enters data at the Wyse terminal to make

an on-line connection with the Boise Public Library computer at the downtown library.

The Wyse terminal has a light pen input, too. Books and periodicals currently circulated have a bar code label for identification. The light pen reads the bar code as a "book ID tag" into the computer.

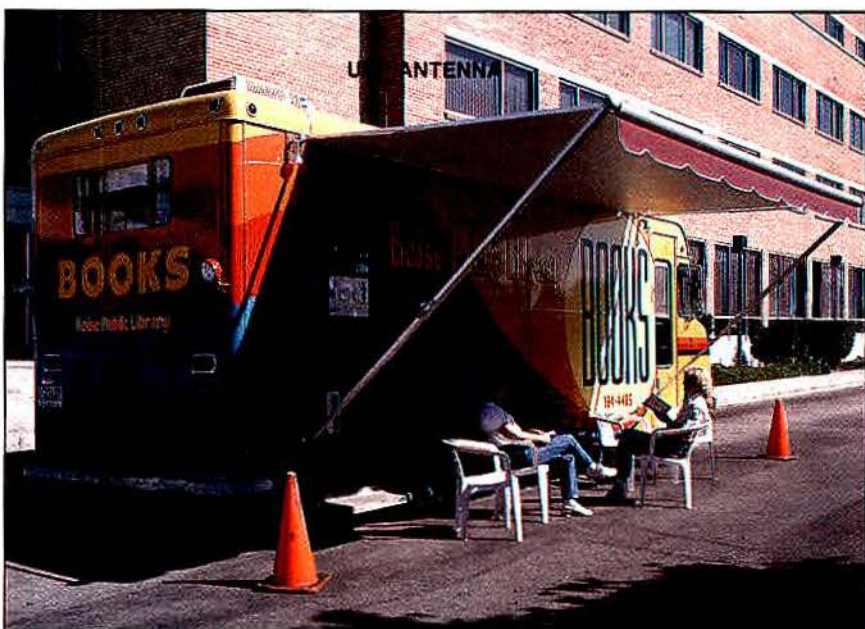
The main computer, an Altos 1075, executes CL Systems automated library software. Normal library transactions, such as book and periodical check-in and check-out and the issuance of new library cards, are conducted using the Wyse terminal, the Altos 1075 and the CLSI software. The remote terminal in the bookmobile operates exactly as the

other computer terminals at service counters in the main library. It uses function key programming to facilitate modem commands necessary to communicate with the CLSI operating system.

Repeater

The library uses a repeater at the city's hilltop communications site, which carries most of the city's radio traffic. All remote bookmobile sites are within sight of the repeater. A shelter at the tower base houses support instrumentation, including a power supply and the radio modem.

The main library's roof supports a radio tower previously installed to hold



Melton is the director of the Boise Public Library, Boise, ID. Emmel is a Boise communications technician.

Shown for display purposes outside the main library, the bookmobile shows no sign of its modern mobile data communications capability other than the UHF antenna on the roof.

The **ifr** FM/AM-1500 with optional CELLULAR TELEPHONE TEST CAPABILITIES



Now you can retain needed service monitor functions and perform cellular mobile tests as well, all with the FM/AM-1500.

IFR offers an option to the popular FM/AM-1500 for the testing of cellular mobile telephones. The FM/AM-1500 with options 08*, 09 and 10 will facilitate the testing of cellular mobile radios in a manual test mode as well as in a cell site simulation mode.

Capabilities include:

- Manual command execution**
- Mobile and cell initiated call processing functions
- Hand-off simulation
- Automatic test
- Control unit test**
- Printer port. (For outputting status or test results to a line printer)

*Option 08—Installed internally within FM/AM-1500

**Per AMPS-May, 1983 specifications



IFR SYSTEMS, INC. 10200 West York Street / Wichita, Kansas 67215-8935 U.S.A.
Phone 316/522-4981 / TWX 910-741-6952 / FAX 316/524-2623

Circle (24) on Fast Fact Card

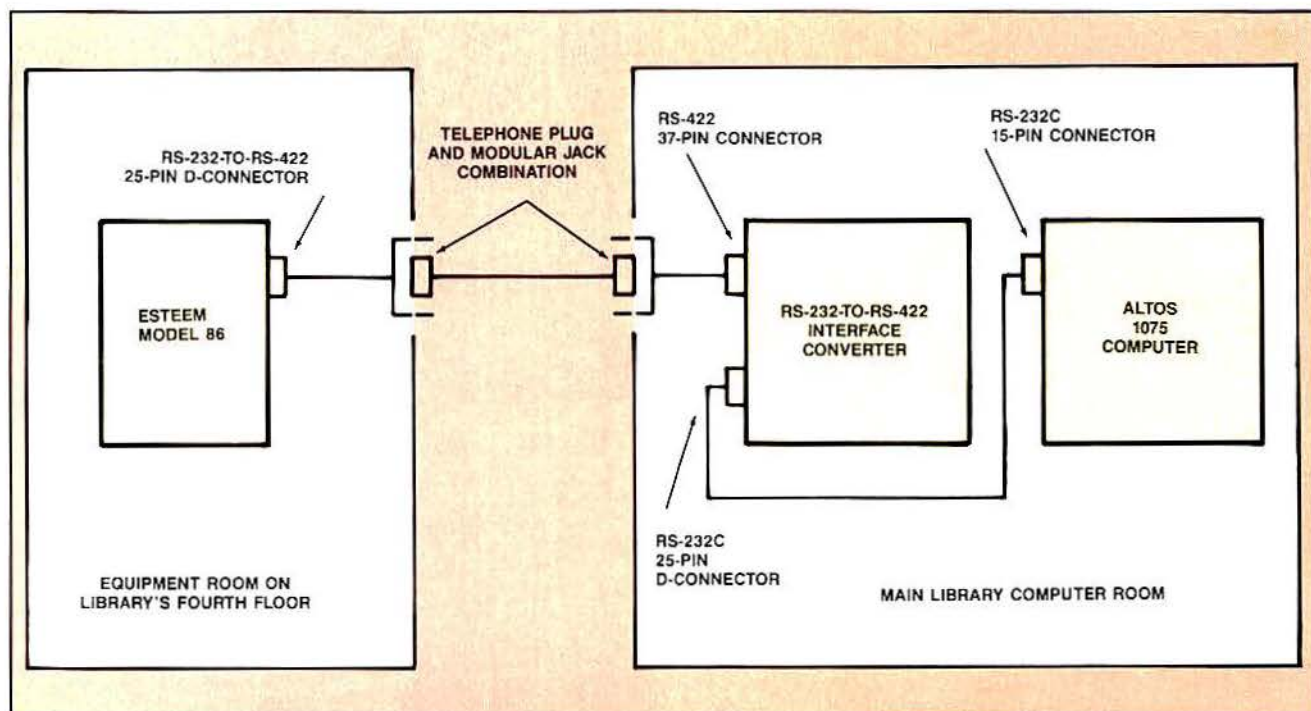


Figure 1. The modem's built-in RS-422 interface transceives signals via four telephone-grade wires to the computer room on the first floor. The wires connect to a stand-alone RS-422-to-RS-232 converter in the computer room. The converter's RS-232 port connects with an RS-232 port on the Altos 1075 computer.

TONE & VOICE

Checkmate III features:

- Attractive ABS Black Case
- Size $3\frac{1}{8}" \times 2\frac{7}{16}" \times 1\frac{5}{16}"$
- Single "AA" Battery
- Variable Volume Control
- Locking Battery Compartment
- Second Tone Group Call Standard
- Standard 3 Year Warranty



Options

- Automatic Reset
- Low Battery Alarm
- 2-Channel
- Multiple Address
- Vehicular/Desktop Amplifier Charger
- Voice Storage
- First Tone Group Call
- Fixed Alert

The Shinwa Checkmate III is a 2-tone sequential tone and voice pager compatible with many tone and voice paging systems such as Plectron, Motorola, and GE.

SCA
Shinwa Communications of America Inc.
P.O. Box 80407 Oklahoma City, OK 73120
1-800-627-4722 FAX 1-800-750-1722

"The Pacesetter in Communications"

Circle (25) on Fast Fact Card

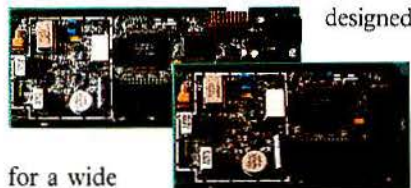
The GPS Brain™ from Magellan.

We give serious thought to your GPS needs.

Magellan, pioneer of affordable GPS technology, understands the need to provide its customers with more than just hardware. As a GPS-dedicated company, Magellan offers its expertise and the capability of customizing hardware and software configurations to help you move into rapidly expanding GPS markets. At Magellan, responsiveness and flexibility in working with customers, no matter how large or small, is an on-going commitment.

PRODUCTS THAT RESPOND TO YOUR NEEDS

Magellan's responsiveness to its customers' diverse GPS needs is exemplified by the Magellan GPS Brain™, a five channel OEM GPS receiver module



designed for a wide variety of integration needs. Available in two configurations, the Magellan GPS Brain easily accommodates such

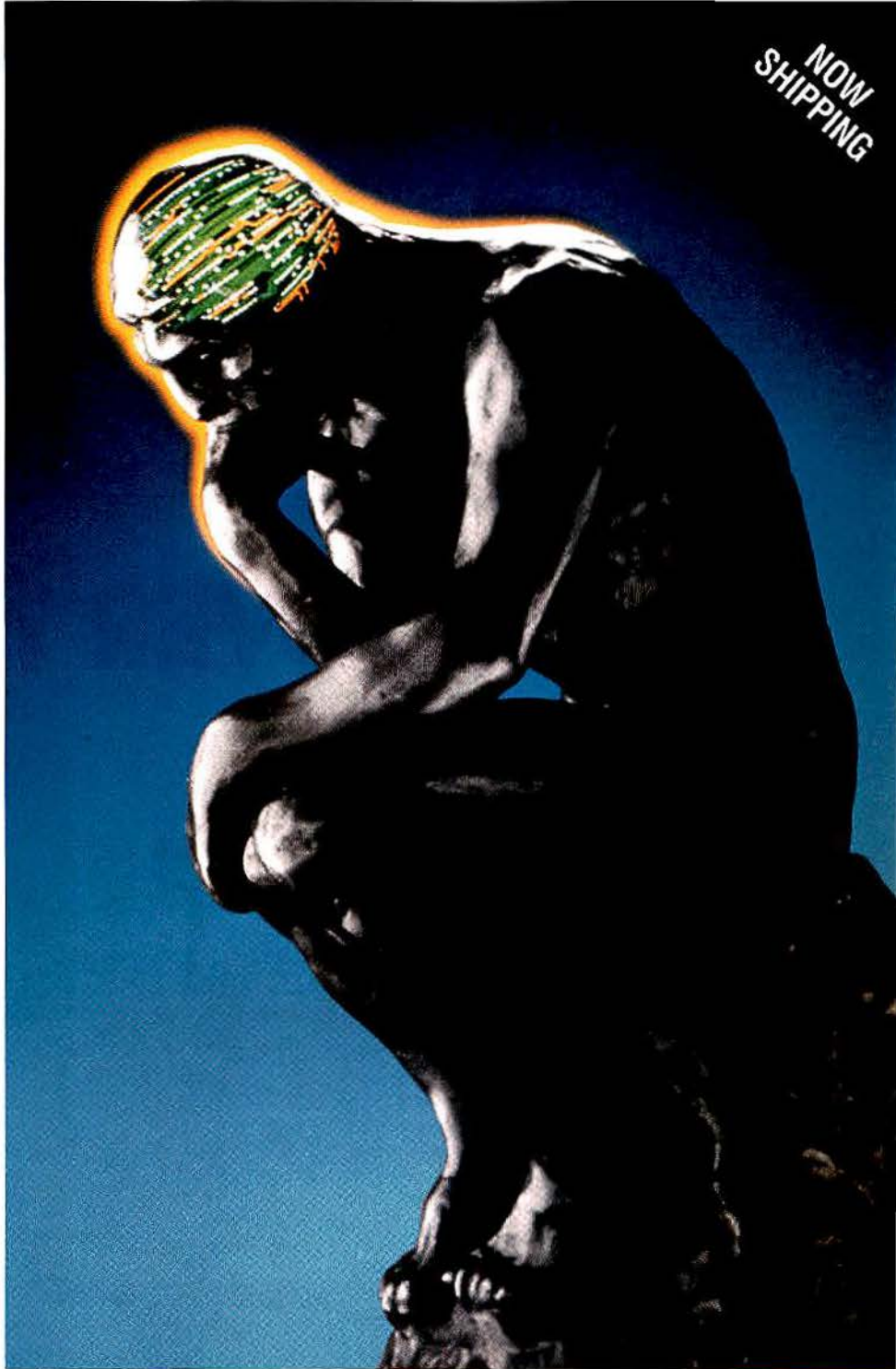
applications as *marine, military, vehicle tracking, vehicle navigation, avionic and scientific*. The GPS Brain has the largest array of standard features available in a low-cost GPS module and accepts real-time differential input for maximum accuracy.

A leader in the field of advanced,

affordable GPS technology, Magellan has earned a reputation for exceptional quality and long-term reliability throughout the world. Whatever your GPS needs, look to Magellan to respond with serious, thoughtful solutions.



MAGELLAN
WE BRING GPS DOWN TO EARTH™



NOW
SHIPPING

VHF antennas for a paging system. The library system's low-gain, omnidirectional UHF antenna tops the tower.

The fourth floor of the four-story main library building is leased by the paging company and includes an equipment room that houses another power supply and modem for the library radio communications system. Placing the radio equipment on the fourth floor

reduced the length of feedline required to reach the antenna, thus reducing signal loss.

The modem's built-in RS-422 interface transceives signals via four telephone-grade wires to the computer room on the first floor. The wires connect to a stand-alone RS-422-to-RS-232 converter in the computer room. The converter's RS-232 port connects with

an RS-232 port on the Altos 1075 computer. (See Figure 1 on page 28.)

Information from the bookmobile travels by radio to the hilltop repeater and then to the library. The modem in the equipment room converts the signals to RS-422 for transmission to the computer room. The signals then are converted back to RS-232 and fed to the computer. (See Figure 2 on page 32.)

UNDERCOVER ?



Forty years ago undercover cars might have looked like this. Today, it's impossible to tell the difference between an undercover car and any other car.

Thanks to STI-CO antennas.

In any bandwidth, STI-CO offers total disguise.

You won't be a dead giveaway.

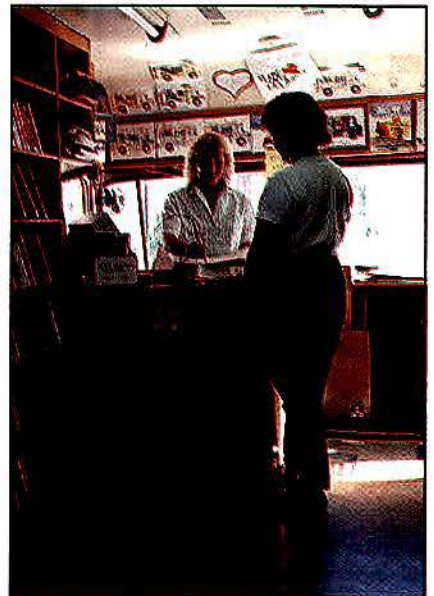
STI-CO
INDUSTRIES, INC

11 COBHAM DRIVE ORCHARD PARK, NY 14127-0656 (716) 662-2680

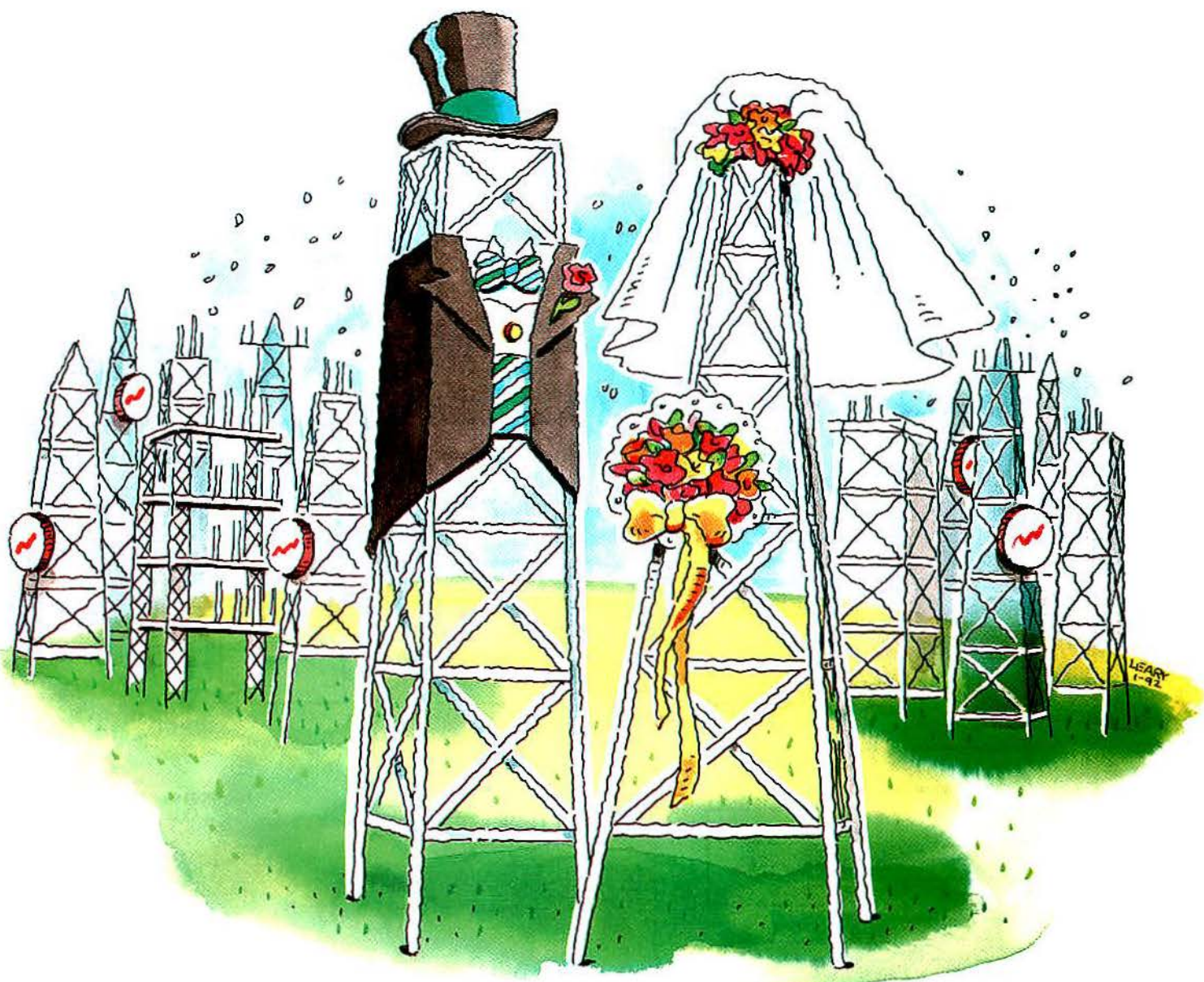
Circle (27) on Fast Fact Card

Information from the bookmobile travels by radio to the hilltop repeater and then to the library.

- *Computer failure*—Before the radio system was installed, the Altos 1075 computer initially was connected to the bookmobile in an off-line batch mode. The bookmobile accumulated data nightly from an on-board Apple computer system and downloaded the information into the Altos 1075 when the



Using a light pen, the bookmobile operator records a transaction on-line with the main library's computer via radio communications.



The perfect match.

When Meridian and Diablo met, it was love at first site. (Antenna site, that is.) And now that they're together, it's a match made in heaven. (Or at least many of California's highest elevations.) Which means if you're looking for sites that serve all of California's metropolitan areas, this marriage can make your job a lot easier.

Together, they act as a combined source, providing radio coverage in California through Diablo's 29 sites covering the Central Valley from Fresno to Chico and the San Francisco Bay Area, and Meridian's 37 sites ranging from Santa Barbara to the Mexican Border.

In addition to giving you access to some of the most sought after and unique sites in the country, Diablo and Meridian operate facilities which provide essential services such as stand-by power, air conditioning, security, and maintenance. And at many sites, you'll find master antenna systems.

Best of all, this happy marriage means that you'll be dealing with companies and people who have over 30 years of experience in the site management business, and who still take a caring and appreciative approach to serving your needs.

Meridian and Diablo—for this couple, the honeymoon will never end.



Meridian Communications

23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355
(818) 888-7000 • Fax (818) 888-2857



DIABLO COMMUNICATIONS, INC.

1220 Brickyard Cove Rd., Ste. 200, Point Richmond, CA 94801
(510) 236-3700 • Fax (510) 236-3799

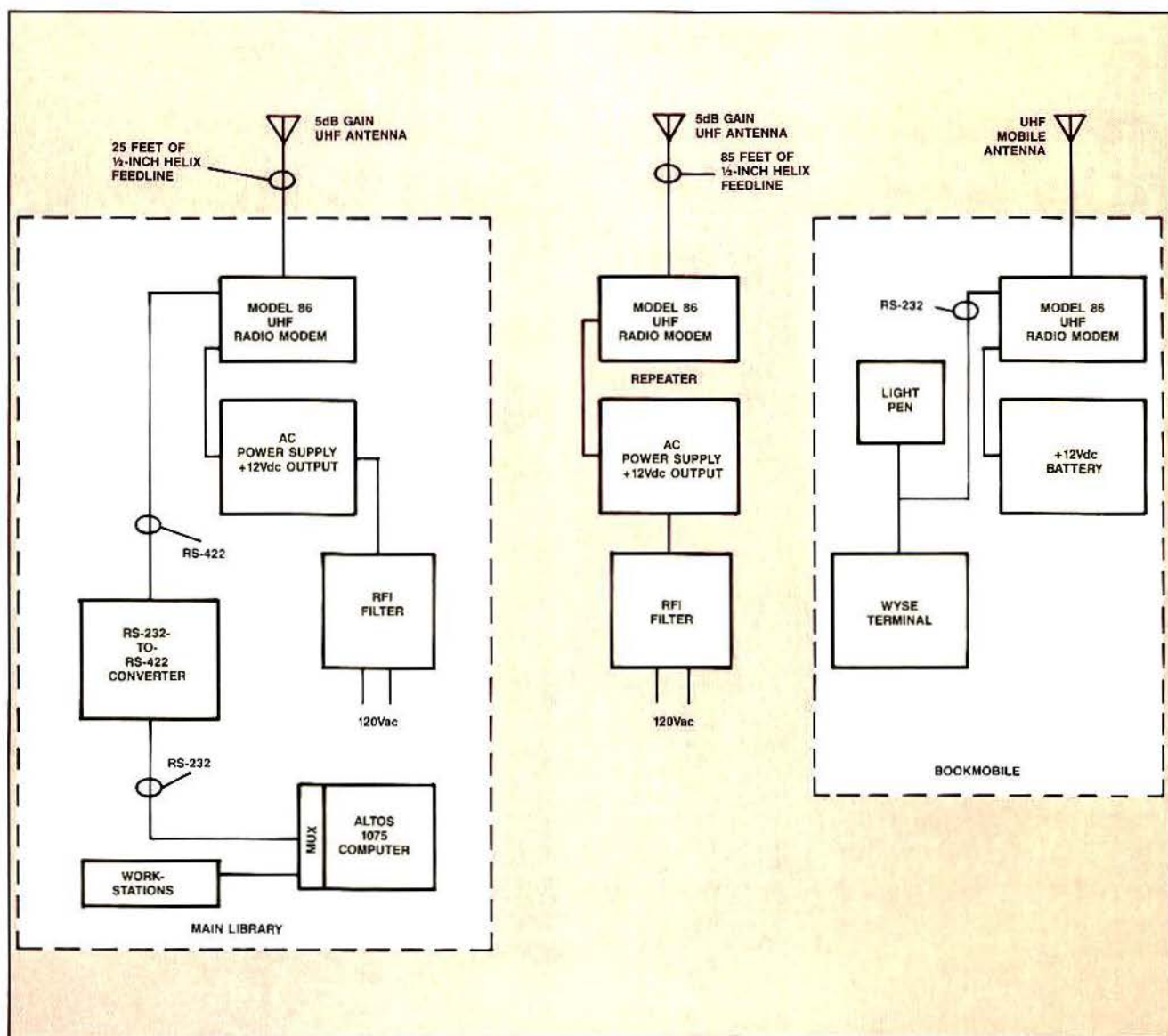


Figure 2. Information from the bookmobile travels by radio to the hilltop repeater and then to the library. The modem in the equipment room converts the signals to RS-422 for transmission to the computer room. The signals then are converted back to RS-232 and fed to the computer.

bookmobile returned to the main library's parking garage.

When the radio modem was installed, its RS-232 output port was connected to the RS-232 port of the RS-422-to-RS-232 converter that feeds the Altos 1075. Inexplicably, this configuration caused the port to lock up occasionally, requiring a complete rebooting of the Altos.

The problem was corrected by moving the modem connection from the converter's RS-232 output port to a port on the multiplexer that connects the main library data terminal workstations

to the Altos. In this configuration, the bookmobile terminal's operation with respect to the Altos resembles all other workstations.

- *Radiolink failure*—The radiolink from the bookmobile to the repeater occasionally failed. The problem was traced to the bookmobile power supply.

When on station and ready to conduct business, the bookmobile uses ac power produced from a gasoline-powered generator. The generator was found to be electrically "noisy." The electrical noise interfered with the radio transceiv-

er's dc power supply. To solve the problem, the radio modem's power supply was converted to a battery source.

Price of progress

Modern radio telemetry products multiply the opportunities for people to learn. The City of Boise's radio-linked library proves the concept.

As with any new technology, there is a price to be paid that includes problems that may arise and that must be overcome.



...POWER UP WITH ASTRON DC TO AC POWER INVERTERS...



**Operate the following equipment from any 12vdc source including
Cars, Trucks, Boats and RV's ETC.**

Laptop and notebook computers

Facsimiles

Battery Chargers for laptop & notebook computers, cellular phones and camcorders.

Computer peripherals, scanners and printers.

Stereos, VCR and TV.

Test equipment, power drills and other electronic equipment.

SPECIFICATIONS

	PI-125	PI-250W	PI-600W
Output power			
30 minutes:	125 watts	250 watts	600 watts
Surge:	200 watts	500 watts	1500 watts
Continuous:	100 watts	200 watts	500 watts
Input Voltage:	10 to 15 VDC	10 15 VDC	10 to 15 VDC
Output voltage:	115 VAC RMS \pm 5%	115 VAC RMS \pm 5%	115 VAC RMS \pm 5%
Output frequency:	60 Hz \pm 2%	60 Hz \pm 0.01%	60 Hz \pm 0.01%
Output waveform:	modified sinewave, phase corrected	modified sinewave, phase corrected	modified sinewave, phase corrected
Efficiency:	90%	90%	90%
Low battery alarm:	10.7 V	10.7 V	10.7 V
Low battery shutdown:	10 V	10 V	10 V
Dimensions (H x W x L):	1.2" x 3.5" x 4.5"	1.5" x 4.5" x 6"	3" x 9" x 10"
Weight:	14 oz.	1.25 lbs.	5.25 lbs.
Protection features:			
Over temperature:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Overload:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Short Circuit:	Electronic shutdown	Electronic shutdown	Electronic shutdown
Reverse polarity:	Fuse	Fuse	Fuse

Circle (29) on Fast Fact Card

ASTRON
CORPORATION

9 Autry • Irvine, CA 92718 • (714) 458-7277 • FAX (714) 458-0826

HF SSB radio bolsters emergency communications

Companies prepare for a potential interruption of normal communications by building HF SSB radio networks. Some use automatic link establishment (ALE) equipment to make radio use resemble telephone use.

By Don Bishop
Editorial Director

Emergencies serious enough to disrupt telephone, VHF and UHF communications can affect electrical power, petroleum and natural gas company operations.

Earthquakes, hurricanes, grass fires and mudslides worry communications network designers at these companies. Accidents within their own facilities can sever external communications, too.

California network

Six Southern California petroleum companies have formed a committee to devise a network for communicating among themselves and with government and military units during abnormal operating conditions caused by an event inside or outside a petroleum facility.

Sam Shriver, communications manager for All America Pipeline, Bakersfield, CA, chairs the committee. He said individual companies' two-way and microwave systems lack a common denominator, such as mutual frequencies and signaling, for external communications.

A big earthquake might interrupt most of their communications because equipment on two mountaintops relay much of the companies' radio and microwave traffic. "The towers on these mountains are 100 feet tall and heavily loaded," Shriver said. "To assume they will still be standing after a big earthquake is begging for trouble."

"Seismologists tell us we can expect a 7.5 [Richter scale] earthquake in our area. After that earthquake, we can ex-



HF SSB equipment carries emergency communications after the Loma Prieta earthquake collapsed bridge spans in the San Francisco area on Oct. 17, 1989. Photo courtesy of Harris, Rochester, NY.

pect a tidal wave of uncertain magnitude that could affect coastal facilities."

Shriver said that communications equipment buildings are expected to receive substantial damage, too. "After such an earthquake, we don't think everyone's microwave and two-way land mobile systems will be operating," he said.

Range requirement

The committee ruled out designing a shared VHF, UHF or satellite system that Shriver said would be destined to fail. "Given the range of communications necessary after an earthquake or

other event serious enough to affect petroleum facilities and communications, there is only one radio service that will fulfill the service, and that is HF SSB," he explained.

HF SSB uses frequencies between 2MHz and 30MHz, according to FCC Part 90 regulations for industrial radio communications. Frequencies are selected so HF SSB signals that leave the earth's surface reflect from the atmosphere and return nearby and at locations as much as hundreds or thousands of miles away.

HF stands for high frequency, which describes the frequency band. HF also is known as shortwave. SSB stands for single-sideband, a method for placing sound and other information on a radio wave to be carried from one location to another.

The petroleum facilities are between Santa Barbara and Gaviota in California, 35 miles to the west. Several offshore oil platforms are included.

Aside from communications among the facilities and with the county government, oil company employees need communications with offices in Bakersfield, CA; Los Angeles; San Francisco; and Houston.

"When the telephone lines and the microwave and land mobile radio sites are down, the only type of communications that will reach that distance is HF SSB radio," Shriver said.

"When severed from typical domestic communications networks, employees in Gaviota still will be able to talk with state emergency services, the Federal Emergency Management Agency (FEMA), the National Guard and Vandenberg Air Force Base," Shriver

The Whole World In Your Pocket

On the go doesn't mean out of touch. ICOM's tiny **R1** receiver keeps you in the know and gives you a whole new perspective on the world around you. It's an entertainment and information gateway that's planet-wise and pocket-sized!

Small Size, Wide Range

The **R1** expands your listening horizons. It receives radio signals used in every country in the world. You can experience information and radio broadcasts you never knew existed.

Enjoy foreign entertainment and news. Or, listen in on world-ranging amateur radio bands. The smallest wide-band receiver of its kind doesn't skimp on coverage. We designed it for 5-905 MHz, but fans tell us they get from 100 kHz right through 1.3 GHz in many locations.

Closer to home, follow the action on the emergency and public safety bands. Get the latest, most accurate NOAA satellite weather forecasts. Listen in to the communications worlds of marine, aviation and business bands. Or relax with broadcast FM & AM— even TV audio!

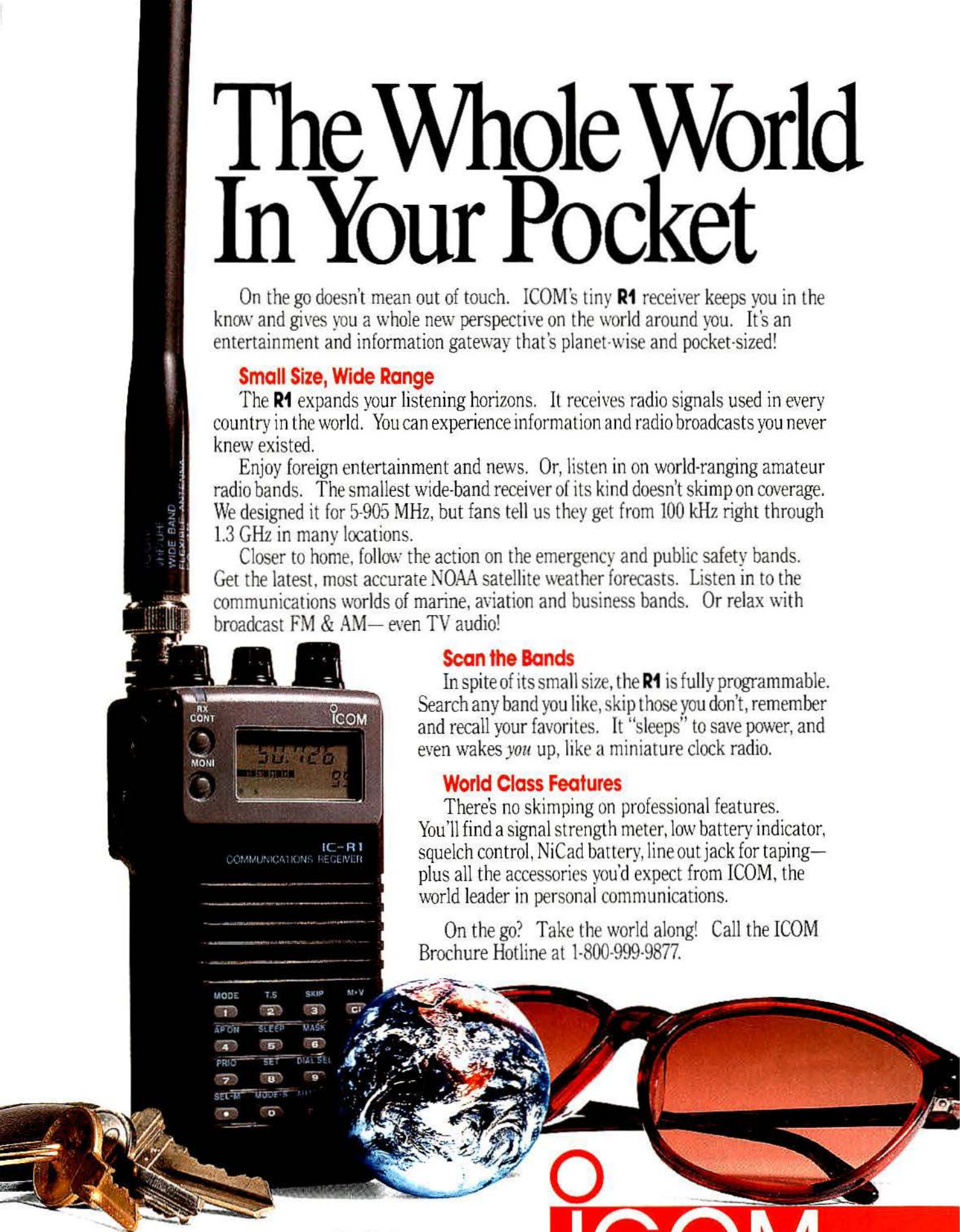
Scan the Bands

In spite of its small size, the **R1** is fully programmable. Search any band you like, skip those you don't, remember and recall your favorites. It "sleeps" to save power, and even wakes *you* up, like a miniature clock radio.

World Class Features

There's no skimping on professional features. You'll find a signal strength meter, low battery indicator, squelch control, NiCad battery, line out jack for taping— plus all the accessories you'd expect from ICOM, the world leader in personal communications.

On the go? Take the world along! Call the ICOM Brochure Hotline at 1-800-999-9877.



Circle (30) on Fast Fact Card

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, Washington 98004
Customer Service Hotline (206) 454-7619

All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions R1392

ICOM
Simply the Best®

DECIBEL

Dedicated to the Fine Art of Radiation Management Worldwide!



An Alliance Telecommunications Company

For Solutions... FAX your Problems to 1-800-229-4706 or (214) 631-4706

Circle (31) on Fast Fact Card

Decibel's Antenna Systems Conquer the Arctic!

In the Beaufort Sea oil operations 80 miles west of Tuktoyuktuk in the Arctic, large icebreaker ships and island stations had tremendous problems with VHF radio antennas and filter products.

The cold to 40° below zero detuned the Tx Combiners and the vibration on the ships was so bad that it literally broke the antennas apart.

Communications managers switched to Decibel VHF equipment on both ship and shore stations, using DB516 Aeroglas™ antennas and DB4350 Low Loss Tx Combiners.

The change paid off.

Decibel's Antenna Systems have survived the

Arctic cold, withstanding the violent vibration and providing frequency stability for more than two years!

An isolated case? No, there are others.

On the Diomed Islands between Russia and Alaska, Decibel's 800-900 MHz equipment is being used successfully for trunked radio communications. Included are DB583 Mirage and DB806D Dual Minimum-Tip-Deflection™ fiberglass antennas, DB8062H Tx Combiners and DB8500 Rx Multicouplers.

They, too, have conquered the icy Arctic.

If Decibel's Antenna Systems can handle the Arctic's toughest jobs — where others failed — surely they can handle yours too! Use the HOTLINE to FAX us your requirements.

An Alliance Telecommunications Company



DECIBEL PRODUCTS

P.O. Box 569610, Dallas TX 75356-9610



Dedicated to the Fine Art
of Radiation Management!

Order Hotline 1-800-676-5342 or **FAX 1-800-229-4706** • Phone (214) 631-0310 • FAX (214) 631-4706

Factory Authorized Warehouses: Antenna Farm, Overland Park KS; Cartwright Communications, Cincinnati OH; Communications Associates, Joliet IL; Communications Express, Clifton NJ; Communications Works, Denver CO; M. Hutton, Dallas TX; Norcross GA; Marktronics, Sunrise FL; Primus Electronics, Joliet IL; Talley Electronics, Hayward CA; Santa Fe Springs CA; San Diego CA; Phoenix AZ; Tescos, Hunt Valley MD; Sparks NV. In Canada, ECD, Calgary, Alberta; Niagara-on-the-Lake, Ontario; Laval, Quebec.

Circle (32) on Fast Fact Card

said. Through AT&T Maritime Services, oil company workers will be able to place telephone calls via AT&T HF SSB stations hundreds of miles from the emergency.

Automatic link establishment

The committee's HF SSB network will use automatic link establishment (ALE). With ALE, radio transceivers select the best available frequency from

a pool of authorized channels.

The radios can be programmed to test the frequency pool periodically and store the best frequency in computer memory for immediate use, or to conduct the test when an operator initiates a call.

Frequencies are tested for suitability because the communications quality may vary widely with the frequency, distance between stations, time of day,

seasons, sunspots and solar flare activity.

"With ALE, the radio network or system can be operated by any company employee regardless of technical knowledge or ability," Shriver said. "For example, should normal communications circuits go blank at 2 p.m. for whatever reason, and if our station at Gaviota needs to communicate with Bakersfield, that would dictate a low frequency, possibly around 5MHz.

"If Gaviota needs to reach Houston at the same time, that would dictate an operating frequency of maybe 18MHz or 22MHz. Rather than having to educate everyone in the company on HF propagation, which is difficult and not feasible or realistic, we have chosen a radio that is microprocessor-controlled and not only selects the correct operating frequency for the task, but it establishes the link by paging a particular radio at the location you want to talk to."

Although the committee does not plan to have radios mounted in vehicles, radios will be available for mobile units

INTERFERENCE LOCATION



- ★ 50 to 1000 MHZ
- ★ Stuck Microphones
- ★ Cable TV Leaks
- ★ Jammed Repeaters & Cell Sites



New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 50 MHz to 1 GHz. Call or write for details.



DOPPLER SYSTEMS, INC.

P.O. BOX 2780 (602) 488-9755
CAREFREE, AZ 85377 FAX (602) 488-1295

Circle (33) on Fast Fact Card

Keep In Touch with ACCESS™

Color Touchscreen Consoles from Avtec



ACCESS™ - Advanced Concept Communications Exchange & Signaling System for Utilities, Airlines, Gas & Oil Companies and Public Safety - A fully integrated, non-blocking, radio/telephone console system using color touchscreen technology. Touch control, pioneered by Avtec for high capacity voice communications systems, is fast becoming the new standard for dispatch consoles.

Avtec is a licensee of the ERICSSON GEMOBILE COMMUNICATIONS EDACS™ trunking system

Call or write today -

AVTEC, INC.

4335 Augusta Hwy. • Gilbert, SC 29054 USA

(803) 892-2181 • FAX (803) 892-3715



Circle (34) on Fast Fact Card

Two ways ROHN's 20 year tower warranty can make money for you



Insurance

Your insurance company may give you a reduced premium. Insurers love the ROHN warranty because it reduces their liability. For the first five years your tower is guaranteed against failure due to ice or wind in excess of design, and it is guaranteed for 20 years against failure due to corrosion.

Site Value

A higher value if your site is sold. The ROHN warranty can transfer to a new owner, and that means your installation is worth more money.



ROHN®

Division of UNR Industries, Inc.

6718 West Plank Road

P.O. Box 2000

Peoria, Illinois 61656

Phone: (309) 697-4400

FAX: (309) 697-5612

Circle (35) on Fast Fact Card

*"43 years of service to the
communications industry"*

and command posts. Three ocean vessels not normally equipped with HF SSB will be fitted with transceivers. The vessels are for use if oil spills into the ocean.

Shriver said his All America Pipeline plans to extend its HF SSB network beyond Southern California. The additional stations will serve a pipeline that extends into Texas. It will be used for

supplemental communications if the company's microwave and satellite systems fail.

Arkansas, Louisiana Gas

The Oct. 17, 1989, Loma Prieta earthquake near San Francisco stimulated emergency communications preparations at Arkansas-Louisiana Gas (ALG), Shreveport, LA. The New

Madrid fault along the Mississippi River is near company facilities. The fault's earthquake potential was publicized widely after the California earthquake.

Eric Tillstrom, a communications engineer for ALG's field communications department, said the company and FEMA cooperated in preparing for an earthquake. Part of the preparation was the acquisition of an emergency communications system.

"We bought six HF SSB radios, fitted them with trickle chargers and marine batteries so they can be moved around, and placed them in district offices in northeast Arkansas where an earthquake could be expected to down radio towers and power lines," Tillstrom said. "The units have automatic antenna couplers, so they will work with a wire strung across a tree limb or to a flag pole."

Tillstrom said ALG applied to the FCC to use about 25 frequencies from 4MHz to 8MHz, frequencies suitable for reliable communications among employees at corporate offices in Shreveport and Little Rock, AR, and workers at affected areas. "Any station would have a 400-to-500 mile range at 8MHz," he said.

Some frequencies are licensed for mobile use so the units can be placed in vehicles.

The gas company's radios are not fitted with automatic link establishment. Tillstrom said the distances between stations allow using a calling frequency to initiate communications. Occasional tests verify the units operate and communicate effectively.

Limited use

Although HF SSB supports critical communications during emergency situations, it seldom is used for routine industrial, business and public safety land mobile and fixed communications in the United States.

The FCC normally grants HF SSB licenses for these applications only when other forms of communications are unavailable and when a lack of communications could threaten life and property.

EXCEPTIONAL WIRELESS TELEPHONE PRODUCTS

DataCom's PhoneLink/DataLink



DATACom

- * Ideal for end users without any technical experience or knowledge.**

If you have ever had trouble with an RF telephone or data link, you know what a frustrating experience that can be. Even the manufacturer can't provide reliable test methods to users that don't have a 2-way shops worth of equipment.

- * Take the trouble out of trouble shooting.**

DataCom's FD line of equipment has enough front panel diagnostic indicators that pinning down the source of trouble can be reduced to seconds.

- * Ongoing support.**

DataCom's service and support lasts long after you have made the purchase. As a matter of fact, we're so confident in the quality and workmanship of our equipment that we offer a 30-day full money back guarantee.

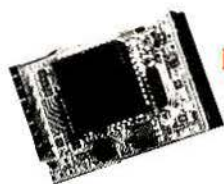


DataCom, Inc.

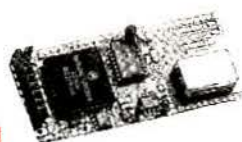
524 North 30th • Quincy, Illinois 62301
217-222-0160 • 217-222-0912 (FAX)
24-Hour Technical Support Available

Circle (36) on Fast Fact Card

Midian Introduces a Whole New Family of Radio Remote Control & Alarm Products



RE-1



RD-1



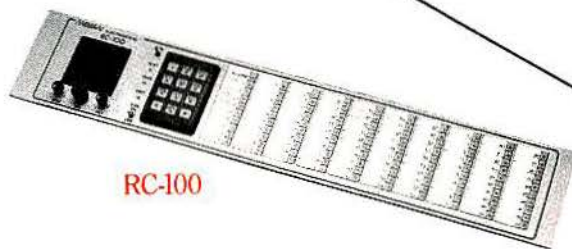
RC-CAD



RC-10



RD-10



RC-100

RC-CAD IBM PC Remote Commander

- Software & Modem interface with your IBM-compatible PC
- Can call any number of RD-1 or RD-10 units
- Alarm application screen displays ID number, Name, Location, Condition, and Time/Date
- Alarm application also provides audible alarm to alert operator
- Remote Call/Control application screen displays ID number, Name, Location, Nature of Call/Command, and Time/Date
- Remote Call/Control application also displays transpond confirmation that event occurred

RC-100 Remote Encoder for 1 to 99 Sites

- Controls functions at up to 99 remote sites (10 RD-10s or 99 RD-1s)
- Built-in keypad for calling each site
- Solid LEDs provide indication that function was successfully completed
- Flashing LEDs indicate incoming alarms

RC-10 Remote Encoder for 1 to 10 sites

- Calls & Controls functions of one RD-10 or up to 10 RD-1s at remote sites
- Provides alarm indications for up to 10 remote sites
- Single Push-button calls each site
- LED next to each push-button provides indication that command was completed with solid light or alarm condition with flashing light

RE-1 Remote Seven-Input Alarm Encoder

- Can monitor a remote site and send up to 7 alarm conditions to RC-CAD, RC-100, or RC-10
- Miniature module fits most radios

RD-10 Remote Decoder for up to 10 Functions

- 10 dry contact relays to control 10 functions
- Can be called to perform a function & send indication that function occurred
- 10 Opto-isolated Inputs for monitoring 10 functions/locations
- Can monitor remote sites and send alarm to many compatible base systems, including RC-10, RC-100, or RC-CAD that a gate has been opened, window has been broken, tank is empty, lamp has failed, etc.
- Wide input voltage range on opto-isolators (AC or DC)

RD-1 Remote Decoder for Single Function

- Miniature module at remote site fits in most portable radios
- Can be called by RC-CAD, RC-100, or RC-10
- Includes Dry Contact Relay Output
- Sensor Input provides transpond indicating that function was successfully completed or alarm condition

To Order Call Toll Free: 1-800-MIDIAN'S
(1-800-643-4267)

Service: 602-884-7981
FAX: 602-884-0422

MIDIAN

World Leader in Innovative Communications Technology

MIDIAN ELECTRONICS, INC. / 2302 East 22nd Street / Tucson, Arizona 85713

IMCE/Spring wrap-up/review

The mobile communications industry's largest show included sessions on regulatory, international and domestic issues and technologies. Here are some of the highlights from the seminars.

By MRT Editorial Staff

More than 75 industry leaders presented information in 27 educational sessions at the International Mobile Communications Expo/Spring, Feb. 18-20 at the Las Vegas Convention Center in Las Vegas. An estimated 8,300 people attended the show, and seminar topics included paging, personal communications service, mobile radio issues, regulatory matters, technical aspects of communications and international market overviews.

Here are some of the session highlights:

□ **Personal Communications Service**—Issues surrounding the development and implementation of PCS continue to surface. "Telocator defines PCS as a broad range of individualized services that enable people or devices to communicate independent of location," according to Anne Phillips, director of PCS/technical projects for Telocator, a Washington, DC-based trade association that represents the interests of carriers.

Telocator's PCS group is reviewing the various issues surrounding the technology, including regulatory matters. The Telocator PCS group includes cellular, telco, paging, bypass, manufacturers and computer companies as members.

"Overall, the goal of the PCS division is to draft a NPRM that they would like to release to the FCC by June 1, and this is a large task, especially for such a broad-based group," Phillips said.

Jeff Cravens, an attorney with Besozzi



Dick Smith: 'It doesn't take a rocket scientist to figure out the impact of cutting your budget in half on running the organization.'

and Favin, believes there will be fast action to get PCS rolling. "The FCC has taken concrete steps down the regulatory road in establishing a home for personal communications services," he said.

"There is a meaningful commitment on the part of the FCC to shorten the regulatory birthing process of PCS. Congress, who is still embarrassed by losing the edge in HDTV to the Japanese, will keep up the pressure," Cravens said.

The FCC will need to determine how much spectrum PCS needs, how PCS fits in with other services and how PCS fits into the PSTN, according to Gregory Vogt, chief of the FCC Common Carrier Bureau's Mobile Services Division.

"The commission is establishing a technical advisory committee made up of industry members to see whether they

can come up with a consensus of what kind of technical standards are required for PCS," Vogt said. "We expect that committee is going to be formed in the near future."

PCS issues to be reviewed include coverage for wide area, how does a network support that capacity, data speeds, standards, connectivity and building a customer base, according to Charles Mason, director of Cellular Data.

Mason referred to a recent Booz Allen study that estimates 30 million Americans will use some type of personal communications device with one-third to one-half of this projected to be data.

□ **Asia, Pacific market**—Asia-Pacific market opportunities are plentiful, according to industry experts. "Paging is the fastest-growing in Asia and Pacific countries with a 33% growth rate per year in the last decade," said Brian Ponte, product planning manager with Motorola's International Cellular Subscriber Group, Arlington Heights, IL.

Paul Nussbaum, senior analyst for Spectrum Ericsson, said: "The Asia-Pacific markets have the most new service providers and the densest populations. We expect the growth rate for paging, cellular and voice mail services to be greater than in any other part of the world."

□ **European marketplace**—The European market is evolving toward common signaling standards, high-quality emphasis in equipment and service, and lower prices.

"There is a plethora of opportunities in the UK, some of which will succeed and some of which will fail," according to John S. Brooks, managing direc-

Family Secrets

Standard's New HX341: Intrinsically Safe, Digitally Private!

The secret is out on the newest member of the Standard family of portables — the HX341.

The HX341 uses new digital technology to give you hundreds of private channel options that improve the efficiency of any communications system.

With Digital coded squelch, users hear only the messages they're intended to, giving you a greater degree of system privacy and less channel clutter.

One Touch Emergency Alert

To make getting attention in emergencies easier, the HX341's Emergency Alert notifies your dispatcher or a priority situation at the touch of a button.

Quality and Features are Standard

One thing that is no secret about the HX341 is the Standard reputation for quality. The HX341 meets or exceeds mil-spec requirements for impact and vibration resistance, with a tough die-cast frame and surface mount components. You know it's made tough.

And of course it's rated Intrinsically Safe for use in explosive atmospheres.

The HX341's five-watt UHF or VHF output can be powered down to 2 watts for longer battery life.

Other features include an optional DTMF keypad, Periodic Sleep Mode for maximum battery life, programmable time out timer, and low battery warning indicator.

The HX341 is field programmable with a non-volatile memory. It clones in the field with a single cable.



**Standard
Communications**

Delivering The Best

A Family Of Accessories

High capacity batteries. Charging options, from rapid-charge compact desktop units, to gang-charging wall units. Add a speaker/mic for use on the belt, and pick the case that best suits your needs. Standard has these and more of the accessories you need to customize the HX341 for any application.

Three Year Warranty — The Industry's Best

At Standard, we stand for quality, and we stand behind our products. We back them with the industry's best warranty — three full years, parts and labor.

See Your Standard Dealer

There's only one place to see the HX341 and find out about the values of the complete Standard Communications Land Mobile family of products, and that's your local Standard dealer. Call us for more information, and the location of the dealer near you.

And if you're a professional radio dealer, and want to offer the kind of values only Standard delivers, isn't it time we met?

tor of Maxon Europe Ltd., Hertfordshire, England.

In other European countries, there exists a vast potential for market penetration, panelists said.

□ **Opening Session**—As barriers and boundaries are opening up amongst former Communist countries, so are the barriers for communications to reach people anywhere, anytime and anyplace.

Parke Davis, director of Industry, Structures and Services, Telecommunications Branch, Department of Communications, Ottawa, said: "WARC (World Administrative Radio Conference) will provide a focus for the international assessment of worldwide personal communications, and its decisions will set a direction."

Even though this "new world order"

"Radio signals know no political borders..."

is developing before us, it will not be easy to reach cooperation for international wireless. Not all countries are developing products and services at the same rate.

Ralph Haller, chief of the FCC Private Radio Bureau, Washington, DC, suggested two ways to make advanced communications easier and more reliable for all: 1) standardization of technical requirements for all countries for radio equipment; and 2) additional transborder use of mobile radios of all types.

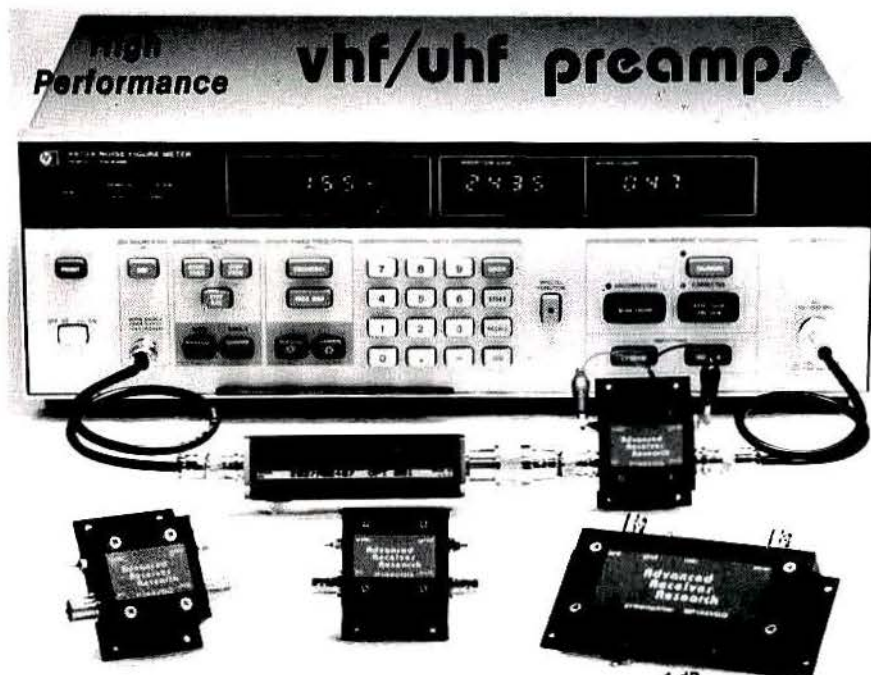
"Radio signals know no political borders, and we should work to eliminate any technologically artificial restrictions," Haller said. "Problems will not be easy to solve but the benefits are very substantial to everyone. More affordable user-friendly international communications will knit the world together like no other means is capable of doing."

□ **FCC open forum**—"The FCC in some ways is a dying organization," said FCC Field Operations Bureau chief Richard M. "Dick" Smith, referring to the effect the agency's relatively unchanging budget has in reducing the scope of its operations in the face of increasing costs.

"Last year, I had \$3.2 million left over after paying salaries to buy equipment, cars and gasoline. This year, I have half that: \$1.6 million. It doesn't take a rocket scientist to figure out the impact of cutting your budget in half on running the organization."

Smith said that Congress is not likely to increase the FCC's budget unless the agency is authorized to collect user fees. A user fee proposal was defeated last year in part because users and trade associations that represent them lobbied against it.

"I don't fault them for that," Smith said. "They didn't feel the fees were equitably divided among the various radio services. But they should have come up with an alternative instead of killing the plan."



Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dB)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	\$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	\$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	\$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	\$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	\$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar	\$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar	\$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	\$119.95
Inline (rf switched)						
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	\$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	\$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar	\$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar	\$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	\$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP346A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

**Advanced
Receiver
Research**

Box 1242 • Burlington, CT 06013 • 203 582-9409



Circle (39) on Fast Fact Card

For Communications That Are Simply Out Of This World



Simply stated, Sinclair's new SRL-490 is specifically designed for cellular, trunking and paging systems. It offers a superior combination of broad bandwidth, high gain and nullfill that is unequaled in the industry.

It's your most economical choice for 800-900 MHz systems.

Sinclair, for simple yet superior antenna performance.

DIALING 800-288-2763 FAX 716-874-4007



SINCLAIR

Circle (40) on Fast Fact Card

Sinclair Radio Laboratories Inc., 675 Ensminger Road, Tonawanda, NY 14150
Call 800-288-2763, Fax 716-874-4007 or write for complete product specifications

How to maintain NiCd batteries

Regular exercise for NiCd batteries extends their service life and keeps their capacities close to the maximum potential. Microprocessor-controlled analyzers use voltage measurements to prevent overcharging.

By Isidor Buchmann

Nickel-cadmium (NiCd) batteries remain one of the most popular power sources for portable radios, cellular telephones, cameras, bio-medical equip-

ment and other battery-powered devices. The NiCd battery is a successful technology because it is easy to recharge; it has a favorable energy-to-weight ratio, it operates over a wide temperature range, it is simple to store, and its price is economical.

The NiCd battery has unique needs that must be met for satisfactory performance. Similar to what a person requires, the NiCd battery needs regular

Buchmann is president of Cadex Electronics, Burnaby, British Columbia.

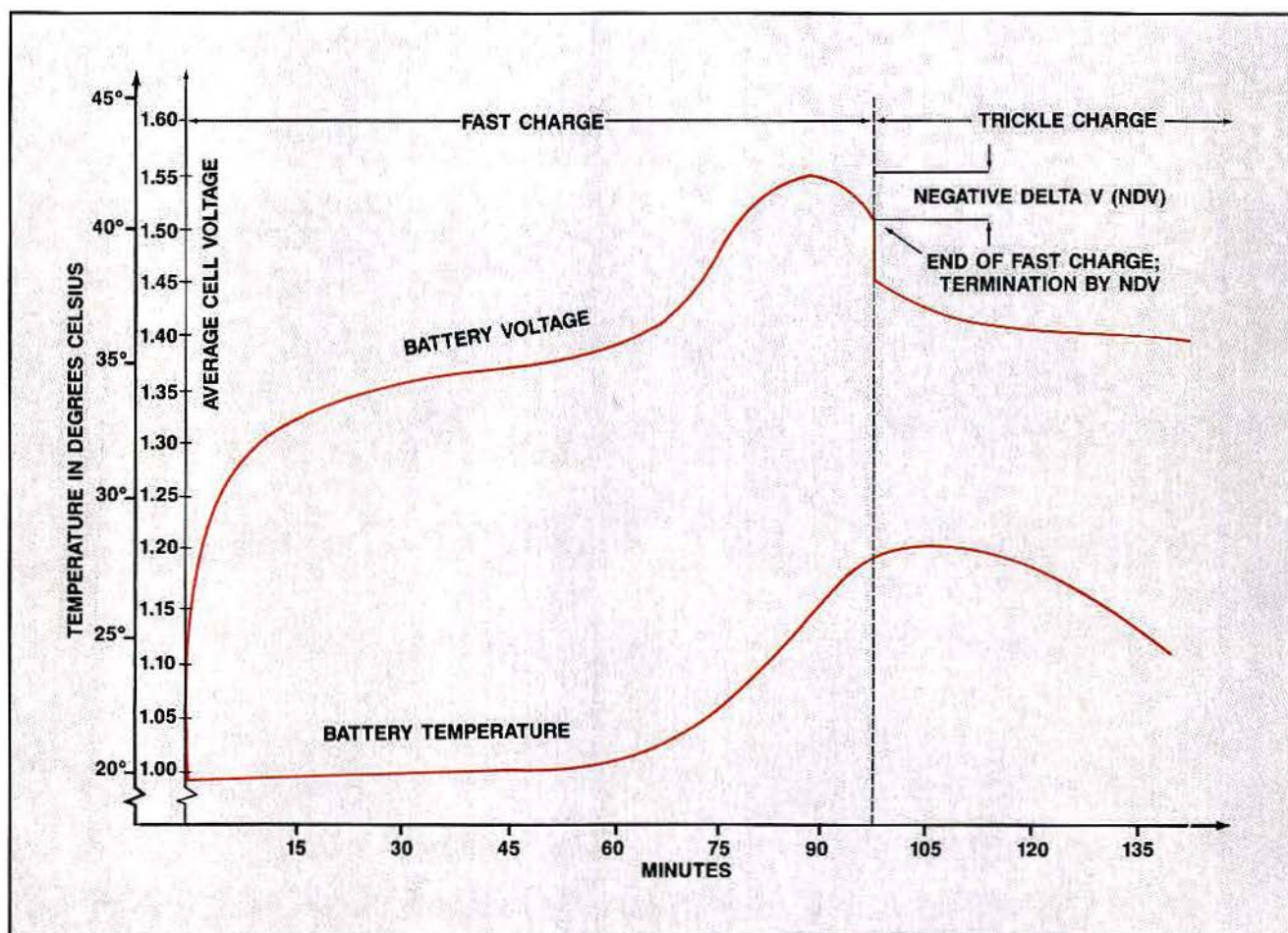
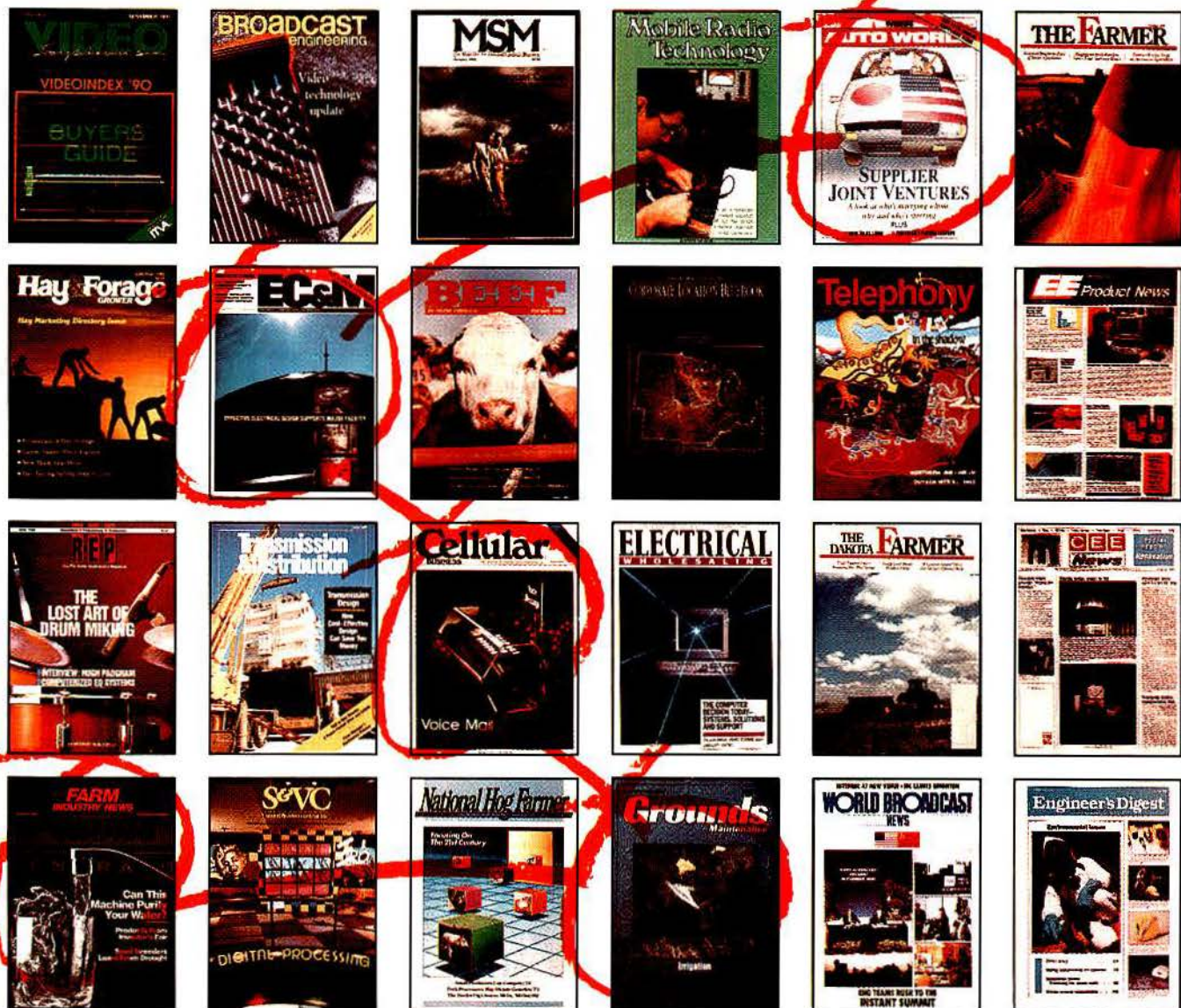


Figure 1. The negative delta V (NDV) voltage slope signature is used to detect the approximate moment when a battery reaches full charge. Provided the cells are well matched, this method is more accurate than the temperature threshold method.



Linking your customers adds power to your sales message and to your ad budget.

Now you can link complementing audiences among Intertec magazines to create the most powerful schedule for your message. And expand the impact of your advertising budget.

Networking potential exists naturally among Intertec magazines, in our Truck/Utility Vehicle, Power Conditioning/Monitoring Equipment, Mobile Communications, and Test and Measurement Equipment network packages.

But that's just the beginning of your network opportunities. You can link together any of Intertec's powerful audiences in an innovative custom network. We'll work with you to create a

synergistic magazine combination that makes the most sense for your product and offers the greatest impact for your message.

Networking at Intertec gives your ad budget a power boost, too. Your network buy qualifies for our all-way combination rate. And that can result in more ad insertions for basically the same dollar investment.

Our network link is a powerful extension of Intertec's multi-industry leadership. Add this power to your message and to your money. Connect with Intertec today.

INTERTEC PUBLISHING

9221 Quivira Road • Overland Park, KS 66215 • (913) 888-4664

exercise and "proper nutrition."

"Exercise" refers to a monthly discharge-and-recharge cycle a NiCd battery needs to prevent voltage depression, sometimes known as "memory." The following information describes some of the causes of improper charging that lead to premature battery failure.

Battery charger technology has not advanced much since the post-war years, except for faster charging. Most fast-chargers measure the cell temperature threshold to detect a full charge. In many applications, this method works satisfactorily. The chargers are inexpensive to build, and the method works reliably in a controlled environment. But sometimes batteries may overheat or may not take a full charge. Here are some of the reasons.

Typical battery thermistors that manufacturers use have a tolerance of $\pm 10\%$.

In some assemblies, the internal thermistor is placed in physical contact with a cell to measure its temperature.

In others, the thermistor may be positioned in the air to measure the battery compartment's ambient temperature. In this case, cells may reach excessive temperatures before the thermistor triggers and terminates the fast-charge routine. For batteries to reach a full charge de-

*...manufacturers who
build thermistor-controlled
chargers tend to make
them so they "cook" the
batteries.*

spite the thermistor method's potential inaccuracies, manufacturers who build thermistor-controlled chargers tend to make them so they "cook" the batteries.

Using modern microprocessor technology, more precise methods have been developed for detecting when a battery

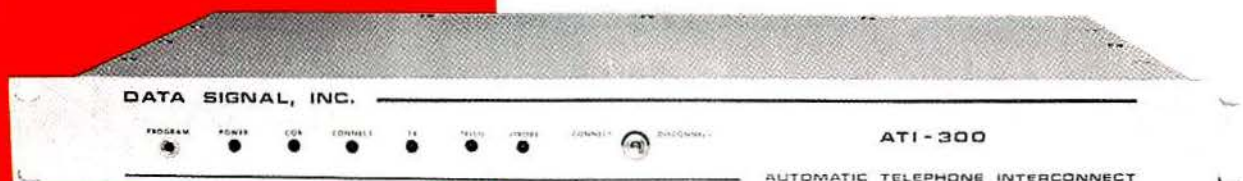
reaches a full charge. The microprocessor monitors battery voltage and terminates the charge when it measures a certain voltage signature. One such voltage signature is the "negative slope" or "negative delta V (NDV)."

Figure 1 on page 46 illustrates the typical voltage behavior of a NiCd battery under charge. The voltage peak coincides with the full-charge state. The charge should be terminated shortly thereafter to prevent overcharging. Notice that cell temperature increases rapidly as the battery reaches full charge.

The NDV method has proven to be more accurate and to respond quicker than the temperature method. For example, if a fully charged battery is inserted into an NDV charger, the fast-charge cycle is active only for a few minutes. The cell temperature does not have to rise to a predetermined threshold. The battery remains cooler, which lengthens its life. The typical amount of battery temperature rise above the ambient temperature is 8°C to 10°C or 14°F to 18°F.

**Feature packed,
Economy priced...**

Automatic Telephone Interconnects



Three quality interconnects, packed with all the features used most often, at prices you can afford. All are dip-switch programmable, and will operate full, half-duplex, or simplex, and come in desk-top or rack-mount enclosures. The simplex models provide digital voice delay.

CHOOSE THE MODEL THAT FITS YOUR NEEDS

The **ATI-100** has regenerated DTMF or pulse dial, direct-voice dispatch, busy channel inhibit and transorb lightning protection.

The **ATI-200** has all of the features of the ATI-100 and adds Toll-restriction, multiple digit access and is microcomputer controlled.

The **ATI-300** can be used as an interconnect, paging terminal or control station. It is completely dip-switch and keypad programmable, and all features are standard. The ATI-300 provides 35 programmable ANI-s, verified positive disconnect, 2-tone page, toll restrict per user, mobile-to-mobile, Selective call, CWID, channel monitor, DTMF or rotary over dial, voice-after page, and three programmable relays. **Priced from \$249 to \$595.**



2403 Commerce Lane
Albany, Georgia 31708

Telephone: 912-883-4703
Toll Free: 800-652-9296

Circle (42) on Fast Fact Card

SCALA

THE WORLD'S FINEST PROFESSIONAL ANTENNAS FOR 900 MHz MULTIPLE ADDRESS RADIO SYSTEMS

Enjoy top performance and maximum reliability from your 900 MHz Multiple Address Radio System, using Scala/Kathrein fixed-station antennas. The full range of directional and omni types includes collinears, panels, logs, yagis, slots and half-parabolics.

Most models include rugged fibreglass radomes to insure reliable operation in icing conditions, a very important consideration at 900 MHz. Designed by Scala and Kathrein, manufactured by Scala in the USA and backed up by Scala's 35-year reputation for the finest customer service, these antennas are "preferred by professionals" around the World for optimum system performance.

We will gladly help with antenna selections and array designs to meet your special needs.

OMNIDIRECTIONAL ANTENNAS

<u>Model</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Pol</u>	<u>Type</u>
UBO-900 (K-7511641)	0 dBd	860-960 MHz	V	Radome-protected Collinear Dipole Array
OGB3-900 (740-251)	3 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
OGB6-928 (740-195)	6 dBd	928-953 MHz	V	Radome-protected Collinear Dipole Array
OGB6-900 (K-7516641)	6 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
OGB9-900 (740-189)	9 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
SL-8 Paraslot®	11.5 dBd	928-953 MHz	H	Radome-protected Eight-Bay Slot Array

DIRECTIONAL ANTENNAS

<u>Model</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>F/B</u>	<u>Pol</u>	<u>Type</u>
TY-900	10 dBd	890-960 MHz	20 dB	V/H	YAGI
RY-900	10 dBd	890-960 MHz	20 dB	V/H	Radome-protected YAGI
CL-900	8 dBd	800-960 MHz	35 dB	V/H	Radome-protected LOG
LP10-900 (K-732261)	10 dBd	790-960 MHz	25 dB	V/H	Radome-protected LOG
BP6-900 (A-6335641)	6 dBd	870-960 MHz	25 dB	V	Radome-protected PANEL
BP9-848 (740-217A)	9 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP11-875 (740-028)	11 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP13-875 (A-633061)	13 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP16-875 (740-215)	16 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
MF-900	14 dBd	890-960 MHz	23 dB	V	MINIFLECTOR®
PR-900	18 dBd	890-960 MHz	25 dB	V/H	PARAFLECTOR®

SCALA ELECTRONIC CORPORATION

P.O. Box 4580, Medford, OR 97501 (USA)

Phone: (503) 779-6500

Fax: (503) 779-3991

The NDV method has a disadvantage: It works only with batteries whose cells are matched. Mismatched cells commonly are found in unprimed, new batteries and aging batteries. Such batteries do not produce an adequate negative slope to terminate the fast charge safely. As a result, the batteries can be damaged or destroyed by overheating. (See Figure 2 at the right.)

To avoid overcharging batteries, some chargers feature a voltage plateau timer (VPT) in addition to NDV slope detection. When a voltage plateau is reached, the fast charge is terminated safely. The voltage plateau timer allows charging to continue only a few minutes longer than it would if a negative slope were detected.

Another diagnostic function detects low battery voltage and "soft" cells. Audible and visible signals indicate "battery connected," "charge completed" and any of six possible faults. For example, faulty batteries are identified, and the charge is terminated to protect the instrument and the battery.

Recent lab experiments have found that NiCd batteries can perform as many as 30,000 charge-and-discharge cycles. It seems likely that a controlled environment, ideal charging methods and high-quality cells were used to achieve these results.

One of the most common reasons for premature NiCd battery failure is voltage depression.

In typical field applications, battery life expectancy is shorter. Nevertheless, the lab tests prove the properly main-

tained NiCd battery's high-performance potential.

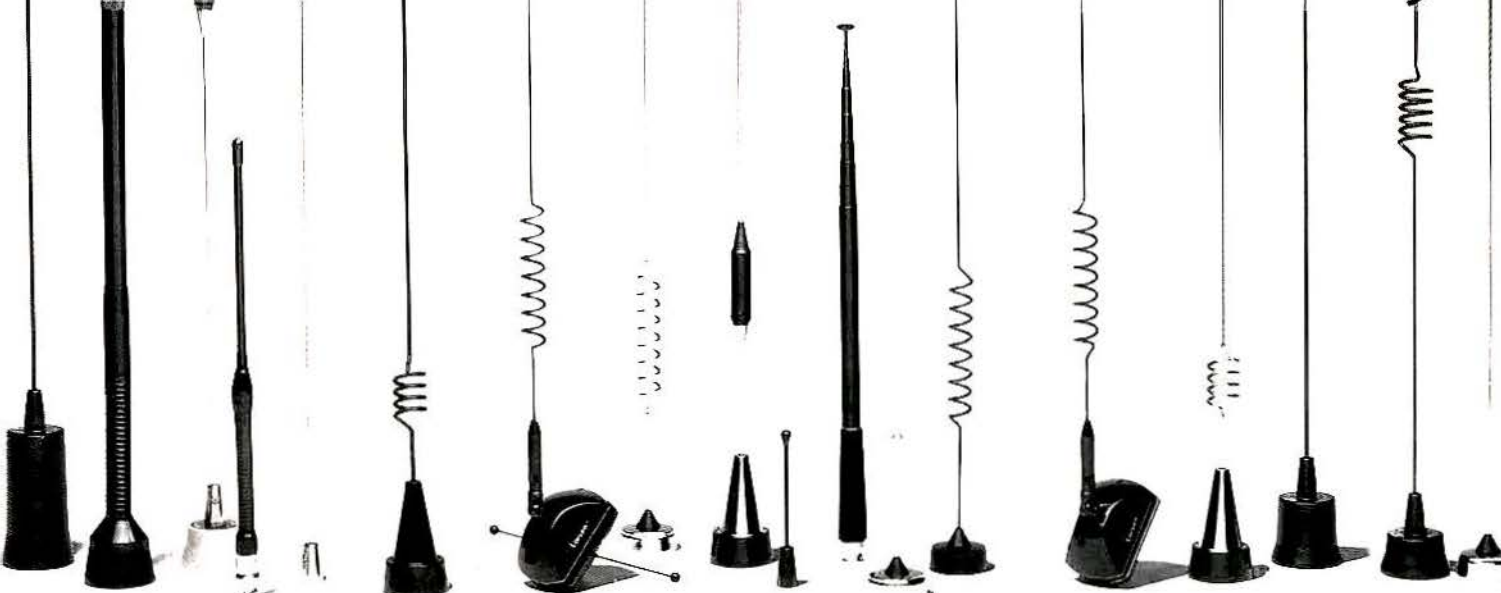
Maximum battery life is obtained with a monthly exercise cycle of a discharge to 1.0V per cell and a subsequent recharge. All too often, users omit this routine procedure as too time-consuming and impractical. Thus, their NiCd batteries may fail to deliver their full potential service life.

Battery maintenance is most conveniently performed by a battery analyzer. Modern analyzers identify and reverse the degeneration process automatically. Batteries are serviced with speed, convenience and reliability.

Battery analyzers check new batteries' performance, too. Certain batches of batteries produce less-than-expected capacities. Without testing, these deficiencies may go unnoticed and may cause problems in the field later.

The analyzer can be used to check batteries prior to their warranty expiration. To promote sales, some battery vendors offer an 18-month warranty that provides for an exchange if a battery

YOU'LL LOVE THEM,



Why? Let us count the ways.

Air-wound coils reduce loss. Soldered connections provide lasting contacts under the most strenuous conditions. Kūlrod® plated stainless steel whips turn maximum power into clear communication. New bases featuring ultra-tough Makroblend™ resin guarantee

rugged, lasting performance. Efficient designs mean fast, trouble-free installation and service.

Larsen Antennas offers a comprehensive selection of mobile, portable, base station and cellular antennas. All made exclusively in the USA to ensure strict quality standards and greater value. We've been setting industry

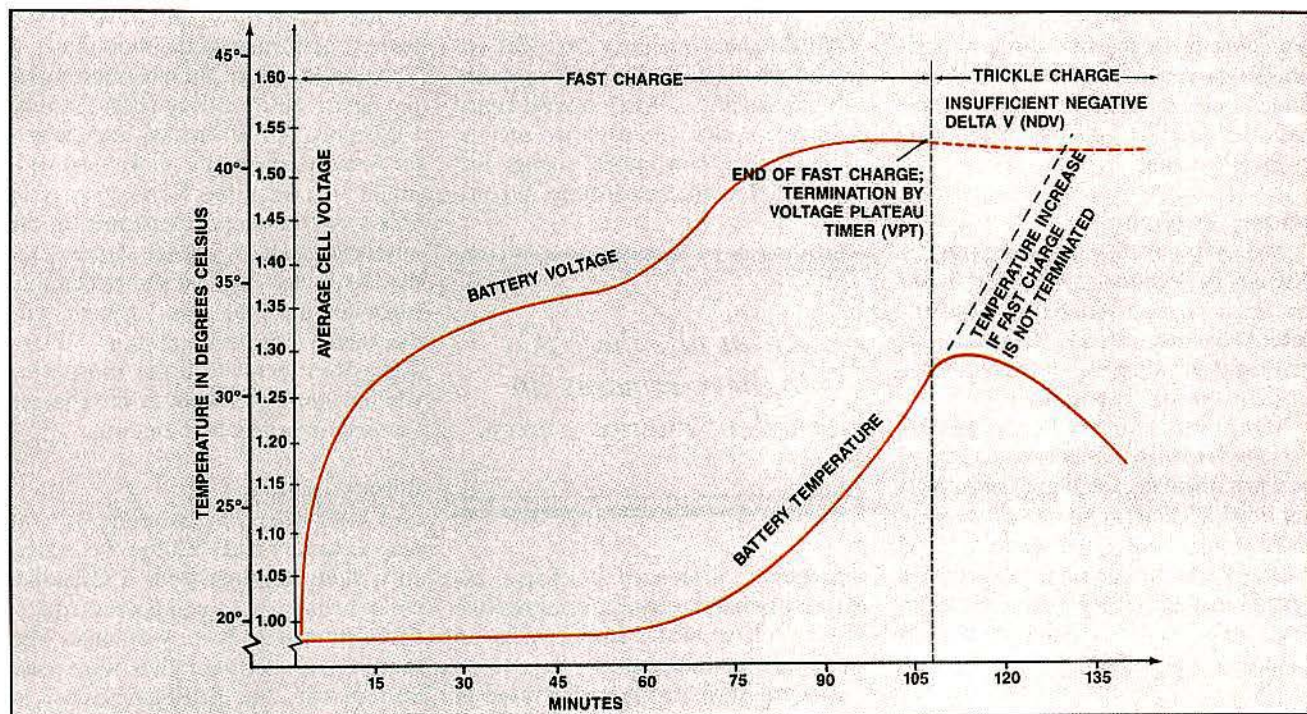


Figure 2. The voltage signature on a battery with mismatched cells. The battery does not produce an adequate slope because each cell reaches a full charge at a different time.

UNCONDITIONALLY.



standards for over 25 years.

Our latest innovation is the Three Year "No Nonsense" Warranty. In the unlikely event that a Larsen antenna fails within three years of purchase, we'll replace it at no charge. It's the best warranty in the business. You'll probably never use it. But you'll love it just the same.



For a free copy of our new 1992 Full Line Catalog, call 1-800-426-1656 in the USA. In Canada, 1-800-663-6734.

Larsen® Antennas

Larsen® and Kiltrod® are registered trademarks of Larsen Electronics, Inc., U.S.A. Makrolend® is a trademark of Miles, Inc.

Circle (44) on Fast Fact Card

fails to meet at least 80% of its nominal capacity during the warranty period. Some vendors count on their customers not to bother checking their batteries to make full use of the warranty protection.

Battery disposal

The environmental problem posed by NiCd battery disposal is gaining in importance. Some users buy the lowest-priced batteries with the intention of discarding them when they lose confidence in the batteries' condition.

Many users who own battery analyzers switch to higher quality batteries and maintain them to extend their maximum service life. The use of an analyzer, on the average, adds one year to a NiCd battery's life. In addition, the battery's operational efficiency increases by at least 70%, and the number of field failures is cut in half.

Memory

Much has been written about NiCd battery memory, which is expressed

more accurately as "cyclic" memory.

NiCd battery memory first was observed among batteries used in earth-orbiting satellites. After several timed discharge cycles, the batteries seemed to remember how much energy had been withdrawn on each cycle. When a

*All in all, the NiCd
battery remains an
excellent energy source.*

subsequent, prolonged discharge extended beyond the previous routine, the battery voltage would drop, causing an equipment malfunction.

Modern separator materials used in the internal construction of NiCd batteries has all but eliminated cyclic memory. Now the word "memory" tends to

be used in describing all forms of NiCd battery performance deterioration.

One of the most common reasons for premature NiCd battery failure is voltage depression. When it occurs, the battery's active materials, nickel and cadmium in crystalline form, grow into spike- or tree-shaped dendrites. In the advanced stage of voltage depression, the dendrites may puncture the thin separator material, causing high self-discharge or an electrical short. Voltage depression seems to occur most often when batteries are kept in the charger for long intervals between use.

Battery study

In 1980, when I was working for a radio and battery manufacturer, I conducted a study together with a Canadian parks board whose equipment experienced premature battery failures. The study found that the radios were used for light duty, but their batteries had to be kept fully charged for operational readiness.

When it replaced all its batteries, the institution attempted to avoid another premature failure by exercising the batteries periodically. The batteries first were exercised after four months.

The results were startling. More than half of the batteries tested had capacities of only 75% of normal. After several exercise cycles, the batteries' capacities rose to the rated value. If maintenance had been delayed much longer, the chances of restoring the batteries to their rated capacities would have been greatly reduced.

Manufacturers of battery-powered devices are fully aware of the weakest link in their products—the battery. To improve product reliability, the manufacturers often recommend high-capacity batteries.

Not only are oversized batteries unduly bulky and expensive, they hold more residual charge prior to recharging than smaller units. Insufficient use during the workshift adds to the likelihood of premature battery failure when a scheduled exercise program is omitted.

All in all, the NiCd battery remains an excellent energy source. It commonly surpasses other battery chemistries on the market. As with any high performer, the NiCd battery requires proper maintenance to endure.

RF POWER AMPLIFIERS MOBILE, BASE & REPEATER

Henry Radio has Amps that are priced right, in stock and ready to ship. As the pioneer in solid-state Amps, Henry builds them to last.

- Lo-Band ■ UHF ■ 10 Watts to
- Hi-Band ■ 800MHz 500 Watts



**HENRY
RADIO**

2050 S. Bundy Drive, Los Angeles, CA 90025.
Toll Free: 1-800-877-7979, Or: 1-310-820-1234.
FAX 1-310-826-7790.



ALSO IN STOCK:

AEA DATA
AOR
ASTRON
BECKMAN
BIRD
CENTURIAN
CUSHCRAFT
FANON
HENRY
ICOM
JABRO
KANTRONICS
LARSEN
MAXON
OPTO
PIPO
RADIUS
TEMPO
UNIDEN
YAESU

Circle (45) on Fast Fact Card

THREE DIFFERENT MICS. THE SAME EXACTING SHURE STANDARDS.

If you're looking for a high-quality mic with the features you need at a price you can afford, Shure has the answer. Three mics designed to fit the needs and budgets of practically any user and built tough to give you the reliability you've come to expect from Shure.

885TT DTMF – QUALITY THAT'S AFFORDABLE. The 885TT gives you an unbeatable combination of economy, dependability, audio quality, and ease of use. It's a continuous-tone DTMF microphone that sets new standards for value and performance.

Features include:

- Illuminated keypad – designed to last and requiring no extra wiring in most cases.
- Million-Cycle Leaf Switch™ – a Shure exclusive, giving you longer trouble-free use.
- Positive tactile feel keys and audible tone to help make number entry easy and accurate.
- Externally adjustable audio and DTMF levels for easy installation.
- Tailored frequency response and Top-Talk Sound Channels™ provide optimum clarity and intelligibility.

890TT DTMF – THE PROGRAMMABLE CHOICE. The 890TT is a burst-mode DTMF microphone with all the features of the 885TT, plus programmable functions, including:

- Auto-dial feature with ten memory locations (up to 16 digits each).
- Last number redial.
- Lithium battery keeps the programmed memory safe for years.

590T – A DYNAMIC PERFORMER. The 590T, featuring a Shure amplified dynamic cartridge, is ideally suited to a wide range of mobile installations. Tailored frequency response provides optimum voice articulation while it discriminates against other sounds. The 590T is a workhorse designed to provide trouble-free service under the harshest conditions.

ALL FEATURE THE SPEED, VERSATILITY AND COST-SAVINGS OF MODULINK® TECHNOLOGY. All three mics are part of Shure's patented ModuLink System I. Modular cordsets allow these mics to plug instantly into virtually all of the most widely used radio transceivers with no hardwiring – making installations and cable replacement, literally, a snap. Replaceable cordsets also help reduce inventory and lower repair costs.

THE FINAL WORD ABOUT QUALITY. At Shure commitment to quality is not simply talk. You'll be able to see and feel the quality of our mics as soon as you pick one up. Because we test them tougher, our mics last longer and perform better.

CALL 1-800-257-4873. We'll rush you a free catalog explaining, in detail, all the features and benefits of Shure Communication mics and a complete radio compatibility chart.



SHURE®

COMMUNICATIONS PRODUCTS

Circle (46) on Fast Fact Card

NOW
ModuLink®
microphones
plug instantly into
VERTEX
plus nearly every
other popular
radio transceiver.

Kustom signs deal with Coded for mobile data terminal line

Kustom Electronics, Overland Park, KS, has agreed to the sale of its DXT mobile data terminal line to Coded Communications, Carlsbad, CA.

Under the agreement, Kustom will receive an ongoing royalty from Coded on its sales of the DXT line and related systems equipment. Coded will acquire

manufacturing, marketing and service rights to the DXT line for North America and certain Pacific Rim countries.

Coded will purchase certain inventory from Kustom, assume existing orders and proceed to manufacture the DXT product.

PolyPhaser extends warranty, support

In an effort to extend its customer support, PolyPhaser, Minden, NV, has extended the product warranty from two years to 10 years on all of its offerings.

Communications Associates distributes Cobra lines

Communications Associates, Joliet, IL, has added Cobra antennas, vehicle security systems and citizens band radios to its distribution line. The Cobra ProLock line includes the Portable, Plus, Ultra and Combo vehicle security systems.

The company also has expanded its warehouse, doubling the space. Additional space was created for expansion, as well as for processing "cut to length" Andrew and Cablewave orders. The distributor stocks more than 60 mobile communications product lines.

Vega names rep for NY, NJ

Vega, El Monte, CA, has selected PMC Associates, Somerset, NJ, as its exclusive representative in New York and in portions of New Jersey. PMC is at 908-563-0366.

Sonic signs rep

Sonic Communications, New Ipswich, NH, has signed comquip as its representative for Texas, Oklahoma, Arkansas and Louisiana. The rep firm is in Dallas at 214-620-2775.

IFR unveils rental program

IFR Systems, Wichita, KS, has incorporated a rental program for selected test instruments. Instruments such as spectrum analyzers, communications service monitors and associated options and accessories can be rented for as little as 30 days.

Under the plan, rental agreements renew automatically each month indefinitely for as long as the test equipment is needed. The rental plans include a purchase provision that stipulates 80% of paid-in rental payments are applied toward the purchase of rental equipment.



If you ever DF from 25 to 1000 MHz and need to do it unobtrusively, you'll want the TD-L8630P-II



Hardly anyone will notice.

This compact unit from Simrad/Taiyo provides radio direction finding capabilities on all frequencies from 25 to 1000 MHz (also 1.6 to 25 MHz with optional antenna). Easily portable, the unit comes with a camera bag sized case with shoulder strap. The unit also operates as a monitor receiver from 100 kHz to 2 GHz. A hand-held antenna with pistol grip is supplied standard, or

for covert operation a special flat antenna is mounted directly on the main unit. Bearing is indicated by a circular LED display and a meter shows field strength. Spare rechargeable battery,



charger and carrying case are included. Police, defense, security, and other intelligence operators no longer have to worry about jammed communications. If you need to locate interference or other RF source, the 8630P-II is the tool for you. And hardly anyone will notice. Send for complete information today, or call toll-free 1-800-426-5565. Simrad. A name you can trust.

SIMRAD, Inc.
19210 33rd Avenue West
Lynnwood, WA 98036
Telephone: (206) 778-8821
Toll-free: (800) 426-5565



Circle (47) on Fast Fact Card

24 HOUR RECORDING



THE RELIABLE WAY

We just put 24 hours of information into a single, easy to handle, easy to load, easy to store VHS tape.

Introducing the TEAC CR300 series communication recorders. They combine the convenience of 24 hour recording on a single VHS tape with the fixed-head reliability of open reel recorders.

The CR300 series can record up to 20 individual channels of audio. With TEAC'S VHS format your recordings are protected inside a compact cassette. So, you don't have to worry about all the problems of handling and storing tape reels.

Additionally, our single VHS transport design saves space, making it the perfect choice for desktop and rack mount installations. The reliability and performance of the CR300 series is enhanced by the features you'd expect from open reel recorders like serial, parallel and redundant operation. And you can configure the CR300 series to meet virtually any system requirement.

So, if you're looking for 24 hours the reliable way in one convenient package call TEAC, the leader in communication recorder design.

From the company that set the standard for VHS fixed-head recording.



TEAC®

Information Products Division

TEAC AMERICA, INC., 7711 TELEGRAPH ROAD, MONTEBELLO, CA 90640, (213) 726-0303 EXT. 461.

Circle (48) on Fast Fact Card

The benefits of belonging

By Thomas Green

As a professional association for communications technicians, ACT represents more than 1,800 highly qualified members. The main goal is to enhance service technicians' professionalism

through a program of information and continuing education.

Various benefits accomplish this goal.

► Member technicians are in a group that enjoys higher status and earnings within the technical community. A national survey showed that members' incomes are substantially higher than the

national average for communications technicians.

► The association provides technicians with first-hand information on changes and emerging technology within the field. By providing the education and information technicians need, the association helps to increase technicians' knowledge and to maximize their income potential.

► ACT assists with career development by enhancing skills; increasing networking opportunities; providing tips on how to protect members' investment; and informing members on how to sell their accomplishments and abilities to employers in this highly competitive professional industry.

► Membership provides the support of more than 1,800 highly qualified professional NABER-certified technicians. Because there is strength in numbers, members' problems become the ACT team's problems, and their concerns are addressed by the team.

► Belonging to ACT offers the chance to have a *direct say* in the direction the technical profession is heading. Technicians have a real chance to make a difference. They become part of the process and help to formulate the direction the profession can take.

Many other vital services come with membership. For detailed information, call NABER's technician services department at 800-759-0300.

Take Your Hands Off Your Radio!



Maximize your performance with the ease and comfort of hands-free radio operation! DTC's most advanced line of communication accessories are built to perform in the toughest conditions. Experience Engineering Excellence!

RHS-3 Single Earpad



**DYNATECH
TACTICAL
COMMUNICATIONS, INC.**

16 Hampshire Dr., Hudson, NH 03051 **1-800-233-8639**

Technician certification examinations will be offered at 120 sites in 43 states on the following schedule:

TEST DATES	REGISTRATION DEADLINE
Sept. 18 and 19	Aug. 24



Green is a communication electronics instructor, Ranken Technical College, St. Louis, and ACT's leadership council chairman. ACT, the Association of Communications Technicians, is a membership section of NABER, the National Association of Business and Educational Radio.

'Competitive pressure' is cited as reason for unlicensed operation

In New York, some two-way radio users begin operations before obtaining licenses as a response to competitive pressure. FCC Field Operations Bureau electronics engineer Judah Mansbach, who works in the agency's New York office, said most of the unlicensed operation on land mobile frequencies in that area involves would-be licensees that begin operating before they receive licenses they have applied for.

"Representatives of car services just starting to do business come to us all the time," he said. "They tell us, for example, 'I have five or 10 drivers now, and the cars are here, and if I don't have the radios, the drivers are going to leave the business. I'm losing money all the time if I can't use my radios.' It's a very competitive business."

Mansbach recalled a case in which a major radio equipment manufacturer's sales representative would allow new customers to use the sales representa-



Judah Mansbach: '[M]any service companies...put their new customers on the air before they are licensed.'

tive's demonstration radios until the customers' license applications were approved—an illegal procedure.



Kevin McKeon: 'Surprisingly, we have found some public safety radio users operating without a license...'

"Prospective customers still approach radio communications service companies to buy radios, and state that they

COMMUNICATIONS REPLACEMENT BATTERIES

**MANUFACTURED IN U.S.A.
BY W & W ASSOCIATES**



W & W ASSOCIATES

29-11 Parsons Boulevard • Flushing, N.Y. 11354
In U.S. & Canada Call Toll Free (800) 221-0732 In N.Y.S. (718) 961-2103
Telex: 5106016795 • Fax: (718) 461-1978

Circle (50) on Fast Fact Card

Regulating technology

want to use the radios immediately. If the service company will not put them on the air at once, they'll take their business somewhere else. For many service companies who need the business, especially new ones just getting started, they will put their new customers on the air before they are licensed. They'll take that chance," he said.

FCC New York office public service

specialist Kevin McKeon added that not only businesses operate unlicensed radio equipment. "Surprisingly, we have found some public safety radio users operating without a license, including a county sheriff and a fire department."

Mansbach said of the sheriff's department: "Here is an agency sworn to uphold the law, and they flout the law by operating unlicensed transmitters. They

knew it was unlicensed, and they didn't care—until we made a trip to visit them."

McKeon said his office usually sends unlicensed operators a letter explaining the licensing requirement and ordering them to shut down their radio operations immediately. "Sometimes they get that letter and ignore it. Then an engineer has to visit the site to verify unlicensed operation and issue a fine. With some of the unlicensed operators, there's an attitude that whatever they can get away with, they will. Until they are confronted with fines and the threat of criminal prosecution, they won't do anything."

One car service that was operating unlicensed transmitters was issued several fines that went unpaid. "We went to the U.S. attorney and obtained a court order to seize their radios," McKeon said.

Aiding and abetting

Mansbach said that although the law provides that aiding and abetting someone who commits the crime of unlicensed radio operation also is a crime, the New York office has not yet charged any radio communications service companies with aiding and abetting unlicensed operation. "That is the next step," he added.

Problems for customers

McKeon said many radio equipment customers do not realize they have to have a license to operate. Some who do know the license requirements go ahead and operate as long as they can without a license. "They can get themselves into a lot of problems if we catch them operating without a license," he said. "Then they have to shut down, pay the fine and settle everything before they can get a license. It is simpler to do things the right way, ultimately. They may get away with it for a while, but it will come back to haunt them."

'Light, mark your tower'

Problems have arisen recently with improper tower markings, and the FCC is warning licensees to make sure their towers are in accordance with the rules. The FCC no longer is going easy on tower marking violations.

"Nothing you do is more important

RELIABLE 2-WAY RADIOS

For Quality manufactured
mobile radiotelephones
with technical support,
custom software,
widebandwidth,
CTCSS tones,
and cloneable

CONTACT:

TAD RADIO

of Canada inc.

(509) 326-1511

Fax (509)326-1430 Canada Ph(604)545-1150
P.O. Box 10160, 612 N. Maple, Spokane, WA 99209

Circle (51) on Fast Fact Card

BEE™

Quality Leather Cases

We're working our hides for you!

Two-way / Cellular / Paging

- Immediate delivery from large inventory.
- Two day delivery on set up orders.
- Logo imprinting. ■ Low pricing.

We stock more top-grain leather cases for radio, pager or cellular models than any in the Industry... call today.



YOUR ONE-CALL SUPPLIER
FOR HARD PROTECTION
AND SOFT LEATHER CASES.

BEE Electronics, Inc.

2655 Gardner Road, Broadview, IL 60153
Toll Free: 800/336-3115 Fax: 800/345-2091

Circle (52) on Fast Fact Card

THE SS7 SUMMIT.

MAY 11-13, 1992
Swiss Grand Hotel,
Chicago

Sponsored by Bellcore,
Telephony Magazine,
Cellular Business
Magazine, and Mobile
Radio Technology
Magazine.

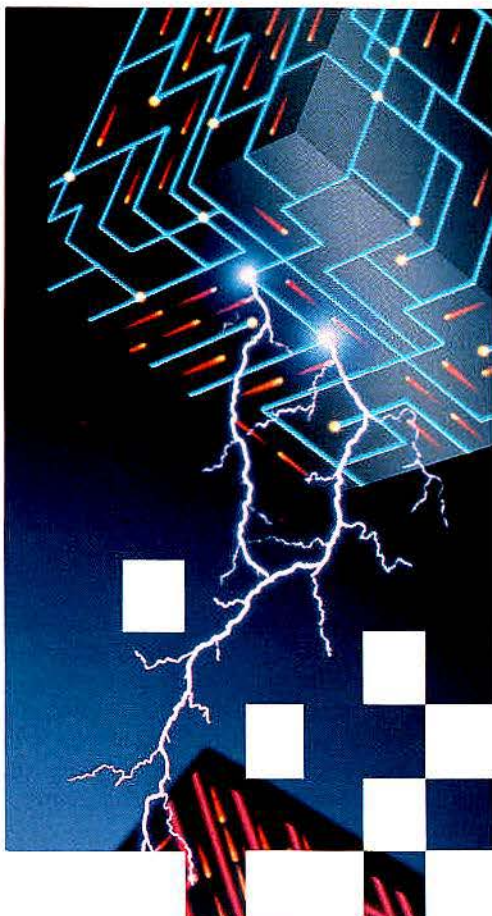
THE SS7 SUMMIT BRINGS THE BEST OF TWO WORLDS TOGETHER.

Join leaders from the public network carriers and major cellular providers as they gather under one roof to set the agenda for the advanced intelligent network.

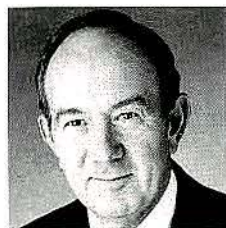
Be there as they resolve turf battles, assess the benefits and challenges of SS7, and their interconnection goals.

And don't miss our SS7 Technology Preview featuring the latest interconnection trial results, SS7 applications and R&D. You'll also have the chance to meet privately with experts from leading vendors, including AT&T, Northern Telecom, DSC, Ericsson, Siemens and Telesciences.

Reserve your place at the Summit now. Seating will be limited. Call Tina Rubin at 800/458-0479 or send her a fax at 312/922-1408 for registration information. Early registration is \$795 (after March 1, 1992, \$895 per person).



Luncheon Keynote Speaker
Alfred Sikes
Chairman, FCC



Luncheon Keynote Speaker
William L. Weiss
Chairman & CEO, Ameritech



Dinner Keynote Speaker
Craig McCaw
Chairman & CEO, McCaw Cellular

Meet These Dynamic Industry Leaders and Many More at the SS7 Summit.

Ray Albers, Assistant Vice President, Technology Planning, Bell Atlantic
Allen Adams, Vice President, Business Development & Strategic Planning, DSC
Bruce J. Becker, Vice President-Planning, Centel
Harry Young, District Manager-Wireless Interconnection, Bellcore
Bruce E. Johnson, Staff Director-Signaling, Telesector Resources Group, a Nynex Company
William Blatt, Assistant Vice President, Technology Planning, Northern Telecom
Joel Engel, Vice President of Technology Management, Ameritech Services
Dennis Foster, President, GTE Mobilenet
Nick Kauser, Senior Vice President & Chief Technology Officer, McCaw Cellular
Michael Hanson, President, Ameritech Direct
John DeFeo, President & CEO, US West NewVector
Robert C. Nitschke, Vice President, Client Services, ITN
Raymond J. Bonelli, Manager, CCS7 Network Services & Support, AT&T Network Systems
Jess Sherwood, Director of Engineering & Operations, ITN, Inc.
Paul R. Zielinski, Director of Regulatory Policy & Industry Relations, Rochester Telephone
Richard E. Tice, Product Manager-LIDB, BellSouth
Jay Kitchen, President, National Association of Business & Educational Radio
Karen Shinevar, Vice President, McCaw Cellular
Michael Warr, Technical Editor, Telephony
William T. Pruett, Director, Technology Strategy, BellSouth
Robert G. White, District Manager, PCS Market Analysis, Bellcore
Rhonda Wickham, Editor, Cellular Business
James Butler, District Manager, CCS Product Management, Bellcore
William Adler, Executive Director-Federal Regulatory, Pacific Telesis
Robert Mechaley, Director, Advanced Technology & Development, McCaw Cellular
Mark W. Beckner, Senior Director-Network Applications Platforms, Ameritech Services
Carol Wilson, Editor, Telephony
Don Bishop, Editor, Mobile Radio Technology
Thomas Stroup, President, Telocator
Fred Gaechter, NAMP Administration, Bellcore
Donald Evans, Director, Federal Regulatory Affairs, MCI
Larry Lannon, Publisher, Telephony
Charles Mason, Washington Editor, Telephony
Don Oas, Group Product Manager, SS7 Services, GTE Telephone Operations
Paris Burstyn, Senior Industry Analyst, Business Research Group
Dennis Byrne, Executive Director, Operations & Engineering, USTA
Wayne Drews, Director of Strategic Business Development, Southwestern Bell Corp.
John Rose, Executive Vice President, OPASTCO
Jamie Solomon, Director, Technology Architectures, CBIS, Communications Systems Group
Christopher Garrett, Director, Network Planning, GTE Telephone Operations
Lonnie Smith, Product Manager, BellSouth
Raymond Donnelly, Vice President of Marketing & Sales, ITN, Inc.
Barry K. Schwartz, Division Manager, Experimental Communications Services, Bellcore
James D. Proffitt, Director, Digital Transition & Standards, PacTel Corp.
Dan Kranzler, President, AccessPlus Communications, Inc.
Robert Maher, President, CTIA
Barry E. Goodstadt, Principal, Telecom Group, Arthur D. Little, Inc.
Richard Harrison, Leader, Network Operation Forum, Exchange Carriers Standards Association
Paul Hart, V.P., Technical Disciplines, USTA
John Wickens, President, PA Consulting
Steve Titch, News Editor, Telephony
Jack Harry, Director of Architectural and Strategic Planning, United Telecom

Regulating technology

than your tower lighting. If you bring down a jetliner that is on approach to an airport, anything else that you do in your business makes no difference," stressed Ralph Haller, Private Radio Bureau chief.

"It is very important to keep those towers lighted and painted, and that's the bottom line," he warned. "The way the Communications Act is written, no matter how many of you are on the tower, individually all of you are responsible for that tower to be lighted and painted.

"So you may be on the tower with a

broadcaster, a common carrier, a private carrier, a taxicab company—all of you should have the same painting and lighting requirements on the license. I urge you if you are not going to take that responsibility seriously to check the tower yourself, that in your contracts with whomever you have given the responsibility to, that you make sure that you have some way to go back and collect damages from the person that is not carrying out the responsibility."

Even an abandoned tower is required to be painted and lighted, he added.

BellSouth subsidiary fined in mobile telephone mixup

The FCC has fined BellSouth subsidiary Mobilecomm of New Mexico \$54,000 for operating six Improved Mobile Telephone Service (IMTS) channels without FCC authorization. Mobilecomm had asked the FCC to cancel its authorization because its management believed operations on the channels, which had been transferred to

Mobilecomm in a business acquisition, had ceased. Later, when Mobilecomm discovered the channels were still in operation, it asked the FCC to reinstate its operating authority. Thus alerted to the period of unauthorized operation, the commission issued Mobilecomm a \$54,000 fine.

Private carrier association expresses 'refarming' opinion

The Association of Private Carrier Paging (APCP) has sent the FCC comments about spectrum refarming in PR Docket No. 91-170 asking the FCC:

- ▶ "to promote greater channel efficiency where cooperation among operators is not achieved readily" by acting on its petition for rulemaking (RM-7837). The petition proposes requiring paging terminal equipment interconnection to reduce interference when operators who share a channel cannot otherwise reach an accommodation.

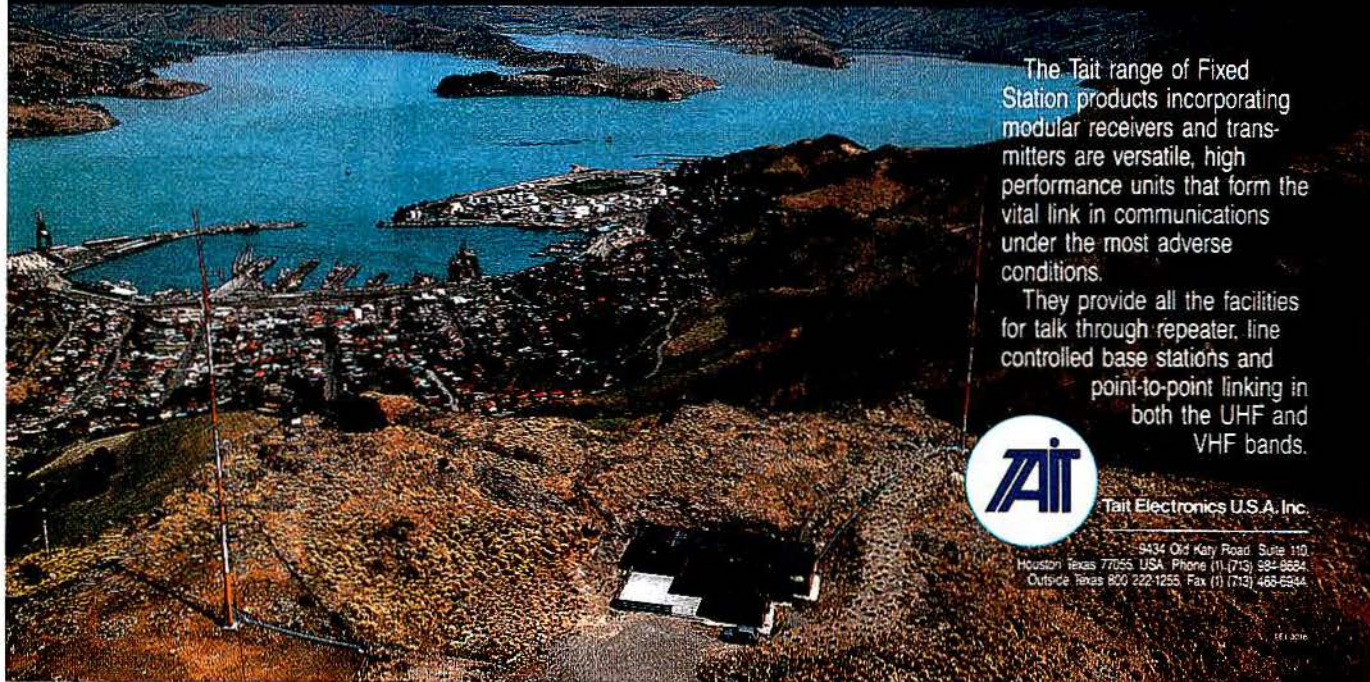
- ▶ to allocate more frequencies for paging-only use at 900MHz.

- ▶ to refrain from splitting paging-only frequencies. Splitting the paging-only frequencies would reduce channel capacity, as smaller bandwidths limit the channel baud rate, according to APCP.

APCP is a membership section of the National Association of Business and Educational Radio (NABER), Alexandria, VA.




THE MOST RELIABLE REPEATER SINCE THE WINCHESTER



The Tait range of Fixed Station products incorporating modular receivers and transmitters are versatile, high performance units that form the vital link in communications under the most adverse conditions.

They provide all the facilities for talk through repeater, line controlled base stations and point-to-point linking in both the UHF and VHF bands.



Tait Electronics U.S.A. Inc.
9434 Old Katy Road, Suite 110
Houston Texas 77055 USA Phone (11) (713) 984-8684
Outside Texas 800 222-1255 Fax (1) (713) 468-6544

Circle (54) on Fast Fact Card

Proof Positive.



WHEN MANAGING A PAGING SYSTEM YOU NEED ALL THE HELP YOU CAN GET. Proving a paging channel's activity or efficiency may be crucial to your company's growth. The VERIFIER can help by showing you data and statistics gathered by monitoring the paging channel directly. Proof positive right off the air, right at your desk.

System MAINTENANCE can be tough,

especially when complaints of missed pages leave you guessing about system failures. The VERIFIER shows you real-time decoded pages and overhead information including binary data if you want. The VERIFIER can easily ride along to the transmitter site because of its small size and because it operates without a PC. Proof positive to solve a difficult problem, right away.

HARK

Hark Electronic Systems, Inc.
1801 Trolley Road
Summerville, SC
Fax (803) 873-5277
1-800-367-4275

FOR MORE INFORMATION CALL 1•800•FOR•HARK

Circle (55) on Fast Fact Card

Readers' choice

Of all the new products and services in the September 1991 issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Pre-amplifier covers 100kHz to 1.3GHz

An adjustable gain receiver pre-amplifier from **Ace Communications** covers 100kHz to 1.3GHz. The unit's amplifier gain is continuously variable from -3dB to +20dB. The amplifier can be used for performance improvement of test equipment, VHF and UHF communications receivers and shortwave receivers.

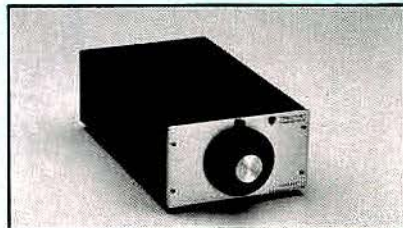
Circle (514) on Fast Fact Card

Alternator noise filter delivers 40A current

The STC40-A alternator noise filter operating in a 13.8V system provides 40A continuous current and eliminates more than 98% of the noise. The **Advanced Electronic Filter** filter for two-way radio applications features an anodized aluminum housing with 10-gauge stranded wire and crimps. The filter drops only 0.8V at 40A.

Circle (516) on Fast Fact Card

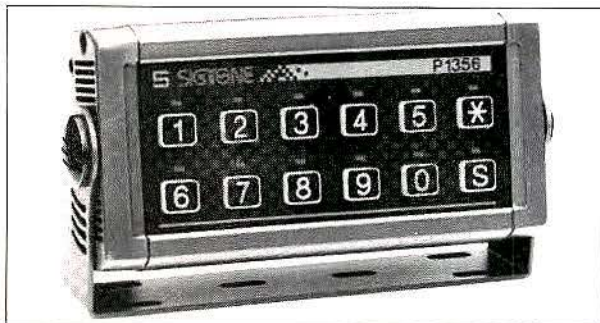
Tunable notch filters cover 25MHz to 1,000MHz



Notches as deep as 50dB and pass-band losses of 1dB maximum are characteristics of **Trilithic's** tunable notch filters. The filters cover 25MHz to 1,000MHz and come with N, SMA, TNC or BNC jacks. Impedance is 50Ω or 75Ω.

Circle (515) on Fast Fact Card

Say it...without a word.



P1356/21 with back lit rubber buttons and rugged metal case



Sigtone® Inc.
225 So. Swoope Ave Suite 105
Maitland, FL 32751

Toll Free 1-800-525-8663 FAX: 407-628-5820

SIGTONE®

Making Your Radio System Do More For You™

LTR® is a registered trademark of EF Johnson Company.

What is Status Reporting

- Status reporting allows vehicle/driver status messages to be sent to the dispatcher with the push of a button, without the need for voice communications from the driver.

No More Wasted Time

- Status reports are sent in the blink-of-an-eye automatically when a channel is available, and automatically acknowledged to ensure the message gets through, just by pushing a button.

Improve Fleet Management

- Identification, status, and selective calling provide the dispatcher with fleet management tools needed to dramatically improve dispatch efficiency and control.

Works on LTR® Trunking

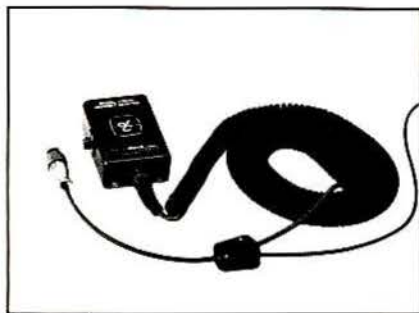
- Sigtone's LTR® Smart version makes operation on LTR® systems completely reliable. The P1356 knows exactly when a handshake has occurred, so there are no "lost" messages. Sigtone's unique and proprietary "Digital Analysis" decoding technique allows our decoders to work reliably at S/N levels as low as 0db, where speech becomes almost impossible.

Other Features

- ANI, emergency alarm modes, silent status interrogation, time-out-timer, horn honk, hidden mic input, and tone blanking are some of the other features available. A P1356 system can be implemented on your existing VHF, UHF, 800/900 MHz conventional or trunked radio system.

Circle (56) on Fast Fact Card

PTT radio adapters allow headset operation to 15 feet



The C3000 PTT radio adapters for use with two-way mobiles interface a David Clark H3300 noise-attenuating headset and mobile. The adapters allow the headset to operate as far as 15 feet from the radio. The adapter includes a belt station with attached RFI shielded cord. The belt station includes a headset jack, PTT switch, belt clip and volume control.

Circle (360) on Fast Fact Card

Antennas, accessories stress durability

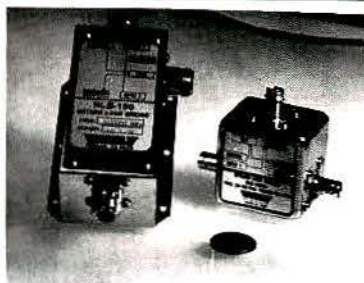
Antennas and accessories from db Mobile offer durability, attractive styling and high quality. Low-cost 3dB series antennas include model APB-137 3dB gain rooftop mount; model APB-287 elevated feed with trunk-lid mount; model APB-337 magnetic mount; and model APB-437 glass-mount antenna.

Circle (414) on Fast Fact Card

Software helps with system planning

The POP-90 population analysis software includes up-to-date 1990 census information for communications systems planning. Updated versions of SHDMAP and RPATH software from EDX Engineering increase the accuracy of propagation predictions with the aid of a PC.

Circle (412) on Fast Fact Card



Return Loss Bridges

RLB150 bridges are a high accuracy low cost solution to SWR measurements. They can be used with spectrum analyzer/tracking generator for swept SWR measurements. EAGLE RLBs have these features:

- Frequencies: .04 Mhz to 1.0 GHz
- RF reflected port
- High Power rating: Five watts
- Rugged construction
- High Directivity: up to 45 dB

Model RLB150B1 .04-150 MHz.....\$259.00

Model RLB150N3B 5-1000 MHz.....\$349.00

FREE application note: "High Performance VSWR measurements", call and ask for it!

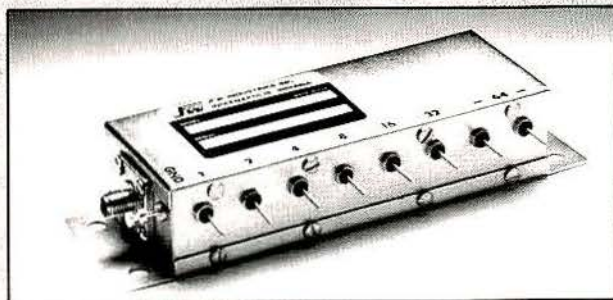
EAGLE
WICHITA

P.O. Box 9446
Wichita, KS 67277

(316) 942-5100
Fax: (316) 942-5190

Circle (57) on Fast Fact Card

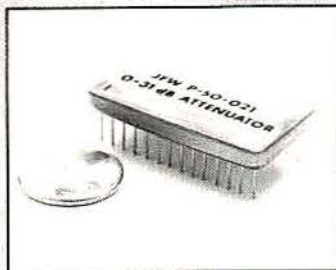
Programmable Attenuators



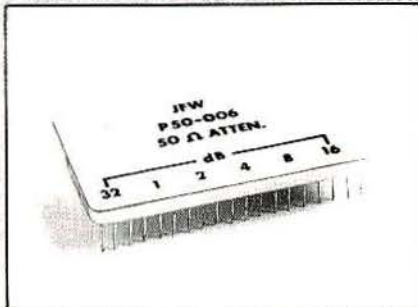
50P-076
Frequency Range
DC-1000 MHz
Attenuation Range
0-127 dB in 1 dB steps



50P-766
Frequency Range
DC-5 GHz
Attenuation Range
0-70 dB in 10 dB steps



P-50-021
Frequency Range
50-250 MHz
Attenuation Range
0-31 dB in 1 dB steps



P50-006
Frequency Range
10-600 MHz
Attenuation Range
0-63 dB in 1 dB steps



JFW Industries, Inc.
5134 Commerce Square Drive
Indianapolis, Indiana 46237
317-887-1340 Fax: 317-881-6790

Circle (58) on Fast Fact Card

New products

16-channel transceiver sports data capability



The 16-channel transceiver from **Fujitsu Ten Corporation of America** includes a built-in alphanumeric LCD with 20 characters. The data-capable radio stores two messages with as many as 40 characters. The messages can be recalled by the mobile radio operator.

Circle (399) on Fast Fact Card

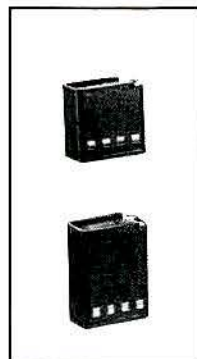
Frequency counter spans 10Hz to 3GHz operation

Model 2810 frequency counter offers 10-digit readout, LCD, 1mV sensitivity and 10Hz-to-3GHz operation. The **Op-toelectronics** tester sports a front-panel selector switch and hand-held operation.

Circle (384) on Fast Fact Card

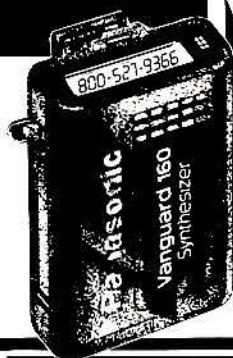
Replacement batteries fit Motorola radios

Replacement batteries for Motorola HT600 and HT800 radios are available from **JaBro Batteries**. Models JB4584 and JB5414 9.6V batteries accept a rapid charge.



Circle (393) on Fast Fact Card

NUMERIC Panasonic



- Synthesized (Programmable/Reprogrammable)
 - VHF (980 frequencies) – Cap Codes
 - UHF (400 frequencies) – Pager Functions
 - 900mhz
- POCsAG Signaling Format
- Up to 8 Address Capability
- Vibrator Standard

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION

P.O. Box 550999 Dallas, TX 75355-0999 Toll-Free 1-800-527-9366 FAX (214) 278-5981

Circle (59) on Fast Fact Card

Hutton Can Supply Your Cable Needs With Celwave Cable



Rolls of cable are in stock
waiting for your orders.

*Hutton has
what it takes!*

NATIONAL STRENGTH
PERSONAL SERVICE
FAST DELIVERY

Quality Celwave cable, connectors, and professional connector installations are available with Hutton's great service. Call Hutton for details.



Hutton Communications

4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

5600 Oakbrook Pkwy. #280
Norcross, GA 30093
404-729-9413
FAX 729-9567
800-741-3811

Hutton National
9810 FM1960
Humble, TX 77338
713-446-4050
FAX 446-5779
800-325-8950

Communications Works
923 West 9th Avenue
Denver, CO 80204
303-820-2929
FAX 820-2809
800-726-6245

Circle (60) on Fast Fact Card

Programmable desktop station delivers 128 channels



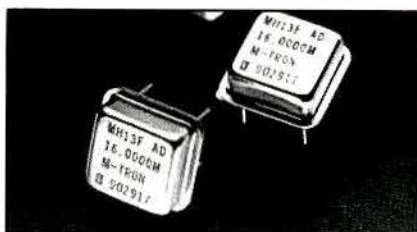
The Spectra field-programmable desktop station from Motorola includes 128 channels for use in allotted frequencies in VHF, UHF, 800MHz and 900MHz bands. The unit features call alert and private conversation functions. Trunked versions can access 240 talk groups and multiple conventional channels.

Circle (357) on Fast Fact Card

Hermetically sealed packaging houses half-size oscillators

The MH series half-size HCMOS quartz crystal clock oscillators come in a hermetically sealed metal package. The M-tron Industries oscillators span 1MHz-to-70MHz frequency range.

Circle (418) on Fast Fact Card



tone & voice



SMALL, POWERFUL AND RELIABLE

- Low band, VHF, UHF
- Two tone sequential
- Single "AA" battery
- Variable volume control
- Locking battery compartment
- Group call command
- Three year warranty

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION

P.O. Box 550999 Dallas, TX 75355-0999 Toll-Free 1-800-527-9366 FAX (214) 278-5981

Circle (61) on Fast Fact Card

Larsen Antennas

CELWAVE



ASTRON CORPORATION

CENTURION

cushcraft/Signals



SHURE



ROHN

Siemens Solar Industries

ANDREW

Multiplier

BIRD

QUANTUM BATTERIES

MAXRAD

ALSO AEE, AMPHENOL, API, AUBURN TECHNOLOGY, BEE, *B&K, BAND-IT, BECKMAN, BELDEN, BOBIER, CAL CORPORATION, CAMBRIDGE, CPI, COMMUNICATIONS SPECIALISTS, COOPER TOOLS, DAVID CLARK CO., EAGLE, FLUKE, GAMBER-JOHNSON, HEART, HELPER INSTRUMENTS, HUSTLER, INNOVATIVE MANUFACTURING, JABRO, *JOHNSON CONTROLS, KENWOOD, METRO TEL, MICROFLECT, MOBILE MARK, MOTOROLA/R-NET, NEWMAR, OPTOELECTONICS, ORA, PACE, PALADIN, PANAVISE, PIPO, POLYPHASER, POWERSONIC, POWER-TEK, RF INDUSTRIES, RITRON, SAT-PAK, SCALA, SCI, SCIENTIFIC DIMENSIONS, SIMPSON, SINCLAIR, *SELECTONE, SMC ELECTROMOUNT, SSC, SPECO, *STANDARD COMMUNICATIONS, STATPOWER, TPL COMMUNICATIONS, TRACE, UNITECH, VELCO, VOCOM, & ZOMEWORKS. *May not be available at locations other than Dallas.



Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

Hutton Communications
5600 Oakbrook Pkwy. #280
Norcross, GA 30093
404-729-9413
FAX 729-9567
800-741-3811

Hutton National
9810 FM1960
Humble, TX, 77338
713-446-4050
FAX 446-5779
800-325-8950

Communications Works
923 West 9th Ave.
Denver, CO 80204
303-820-2929
FAX 820-2809
800-726-6245

Circle (62) on Fast Fact Card

Why Pay More For a Premium Antenna?

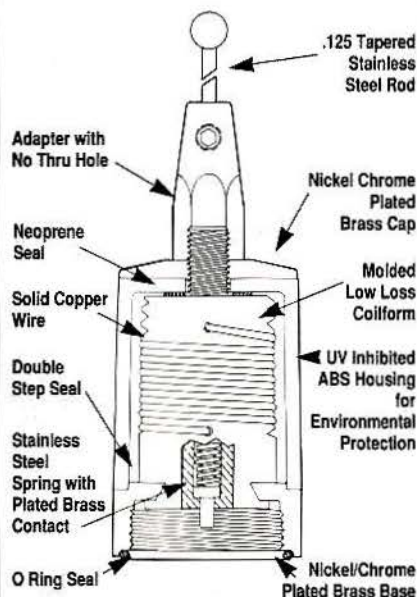
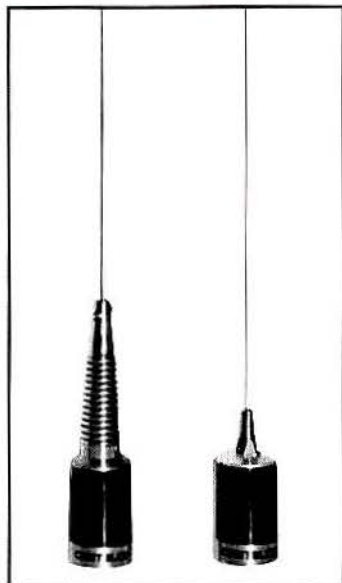
Base Loaded Antennas

UHF/VHF 3dB \$12.50 ea.

UHF 5dB \$15.25 ea.

Shock Spring Version Also Available

- Heavy Duty Construction
- Waterproof
- Corrosion Resistant
- Fits TAD/NMO Mounts



Call For Free Product Data Book

1-800-634-4622 Fax (708) 790-9799
Quality Products Made in the USA since 1978
Comtelco Industries, Inc.
501 Mitchell Rd., Glendale Hts., Illinois 60139

Circle (63) on Fast Fact Card

New products

Duplex interconnect includes programming keyboard

Model CS-800 full-duplex interconnect unit can be programmed for full- or half-duplex operation. The **Connect Systems** unit has a built-in repeater maker, nine-number memory speed dial, built-in programming keyboard, digital display readout and other programmable features.

Circle (388) on Fast Fact Card



Portable handles voice encryption

Model M-PA Voice Guard portable radio from **Ericsson GE Mobile Communications** suits conventional uses and GE's digital access communication system (DACS). The hand-held with voice encryption comes in select, scan or systems models. The radio is available in VHF and UHF bands in the conventional version and in both UHF and 800MHz bands in the DACS dual-mode versions.

Circle (392) on Fast Fact Card



INTRODUCING THE NEW *VERSA LOGIC*



The new *Versa Logic* board puts superior talk power in your SMS 300 series radios with features like:

- Increased channel capacity to 99 systems and up to 1,000 groups.
- Selectable audio companding on dispatch and interconnect.
- Standard or Cellular "Look-a-Like" modes.
- Selectable Normal or Priority Scan.
- Out of Range Queuing.
- Direct Plug in Compatible.
- PC Programmable through the handset cable.
- One year exchange warranty.
- User friendly programming

Call today for more information and introductory pricing

SMC WIRELESS

12519 Wanda Lane Magnolia, Texas 77355
(713) 255-2246 / (800) 736-4150 / FAX (713) 255-3322

Circle (64) on Fast Fact Card

Dispensing hand tool handles thick fluids

The DispensGun hand tool applies solder and brazes plates, as well as applies other thick fluids such as thermal compounds, grease, epoxies and glues. The **ESP Solder Plus** dispensing tool has a 3:1 mechanical leverage that can be adjusted for normal or small hand grips.

Circle (400) on Fast Fact Card

Cellular channel monitor logs, displays data

The Cellscope 2000 cellular radio diagnostic monitoring system offers cellular radio monitoring, traffic analysis and identifies problems associated with the MTSO. The **TSR Technologies** system logs and displays statistics, monitors user-selectable channels and scanning, and monitors base station and follows specific calls.

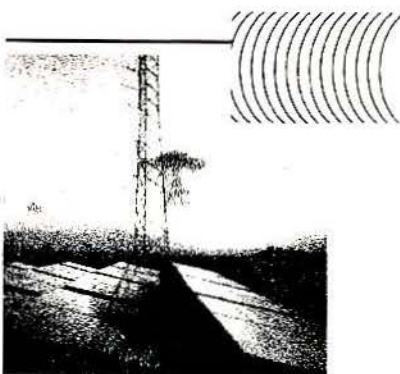
Circle (426) on Fast Fact Card

System software calculates SMR signal level

The radio system design software includes an SMR signal planning capability for calculating signal level and interference ranges for existing and proposed sites. The **JMA Applied Spectrum Research** software allows for single- and multisite design, frequency reuse planning, real world propagation studies and FCC broadcast and Carey contours.

Circle (413) on Fast Fact Card

SIEMENS



The Power to Communicate *Anywhere*

Solar electric power: proven reliable on mountain tops around the world. Complete integrated systems. Modules are UL® listed, 10 yr. warranty.

Solar Electric Specialties

P.O. Box 537, Willits CA 95490

800 344-2003

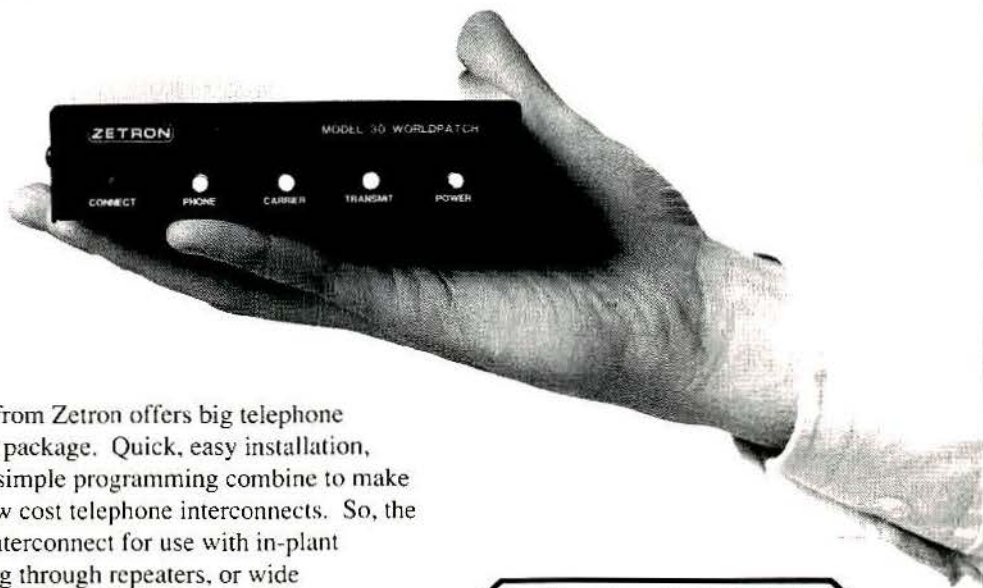


Siemens Solar Industries

Circle (65) on Fast Fact Card

Great Things Come In Small Packages!

When you need
an economical,
high-performance
telephone
interconnect . . .
Zetron gives
you a hand.



The Model 30 WORLDPATCH from Zetron offers big telephone interconnect capability in a small package. Quick, easy installation, Zetron quality performance, and simple programming combine to make the Model 30 the best value in low cost telephone interconnects. So, the next time you need a telephone interconnect for use with in-plant systems, control stations operating through repeaters, or wide area single user systems, order the Zetron Model 30.

**Zetron sets the pace with the finest
in communications signaling products.**

ZETRON

12335 134th Ct. N.E.
Phone: (206) 820-6363

Redmond WA 98052
Fax: (206) 820-7031

Circle (66) on Fast Fact Card

Pressure Situation! . . . Perfect Solution



ProTalk



Radio & Telephone Voice Alarm

Protects you against Intrusion, Equipment Failure, Process Upset, Power Loss, etc . . .

- Crystal clear digitized voice messages
- Completely field programmable
- 8 inputs, 4 outputs, expandable to 64 and 32
- Dials up to 16 numbers in 2 directories
- Easily installed, cost effective

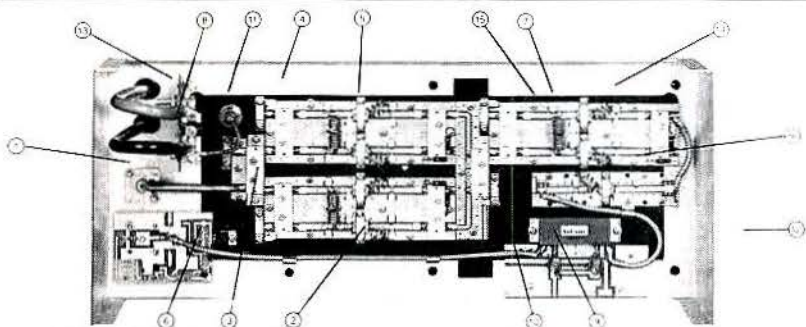
Ask about our full line of digitized voice alarm systems, emergency shutdown systems, and telecommunication products. Dealer inquiries welcome.

Call Toll Free 1-800-268-2646

BE BARNETT ENGINEERING LTD.
(403) 255-9544 FAX (403) 259-2343

Circle (67) on Fast Fact Card

16 REASONS TO BUY OUR RF AMPLIFIERS



A bad amp can be your worst nightmare. Ask us what we've been doing over the past 11 years to make your dreams come true. Our Catalog details 16 important technical points you should know before you make a commitment to an RF amplifier supplier. Our product line includes:

- VHF Low Band to 400 watts
- VHF High Band (140-200 MHz) to 300 watts
- UHF Low Band (400-550 MHz) to 400 watts
- UHF High Band (800-960 MHz) to 150 watts
- True continuous rating at high ambient temperatures
- "Bullet-Proof" heavy duty protected amplifiers for mobile and simplex applications

VoCom/RF Corporation

Quality since 1979

1/800-872-6233

Call 1-800-USA-MADE

In Illinois 708/885-3296

Circle (68) on Fast Fact Card

New products

VHF, UHF portables provide 5W output



The SH505FDT VHF portable and model SH405FDT UHF portable come with a 600mAh battery and offer 5W RF output. The synthesized portables include CTCSS, power save function, keyboard light and keyboard lock. Channel capacity is 10 to 60, and the

portables are available from **Shinwa Communications of America**.

Circle (364) on Fast Fact Card

Receiver monitor panel checks eight receivers

Model 27 receiver monitor panel allows an operator to monitor as many as eight receivers. The rack-mount panel from **Zetron** includes balanced audio inputs of either 600Ω or 10,000Ω. The unit sports a VOX LED display on its front panel for each receiver being monitored. The panel's built-in speakers have independent volume controls.

Circle (403) on Fast Fact Card

Belt pack headphone has no visible mic



Model BSH-4N headphone for belt pack applications contains no viable mic. The **Earmark** unit includes a protective earmuff with the mic built in. The headphone has its own 9V carbon cell power supply, and audio circuitry is built in the headphone.

Circle (341) on Fast Fact Card



Catalog describes antenna line

Cellular and trunking antennas, base stations and land mobile accessories are described in **Maxrad's** catalog. Color-coded technical charts and tables highlight electrical and mechanical specifications, mount options and coaxial cables.

Circle (256) on Fast Fact Card

Lighting guide details products, offers tips

A guide, from **Hughey & Phillips**, aids customers in solving hazardous air navigation problems by providing product selection for existing FAA, FCC, Transport Canada and ICAO regulations and requirements. The tower and obstruction lighting guide and catalog details red light products; medium-

intensity white light strobes; red light strobe kits; medium-intensity strobe kits; dual red and medium-intensity strobe lighting kits; tower lighting monitoring systems; temporary lighting systems; and other marking and accessory products.

Circle (254) on Fast Fact Card



Securitron

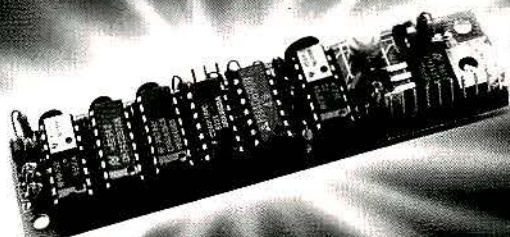
Model 813A

Radio
Station
Identifier

Now there is a compact, affordable Morse code identifier that's perfect for Common Carrier, Maritime, Aviation, Land and Amateur radio identification. Introducing the Securitron Model 813A. The Model 813A features multi-mode operation, field replaceable memory, adjustable audio and programmable code speed, tone and repeat interval ... all in a rugged miniaturized design. For complete details on the Model 813A, contact Securitron today.

(408) 263-6434

Securitron Company • P.O. Box 32145, San Jose, California 95152



Circle (69) on Fast Fact Card

MORE EMI/RFI PROTECTION

HIGHER PERFORMANCE

Independent tests show Lindgren's double-electrically-isolated (DEI) design assures higher shielding effectiveness in low-frequency magnetic and high-frequency electric fields.

MORE SHIELDING SYSTEM OPTIONS

We offer a complete line of modular enclosures, cabinets, and custom rooms.

Shielding materials, in solid-sheet or screen, cover almost any shielding requirements.

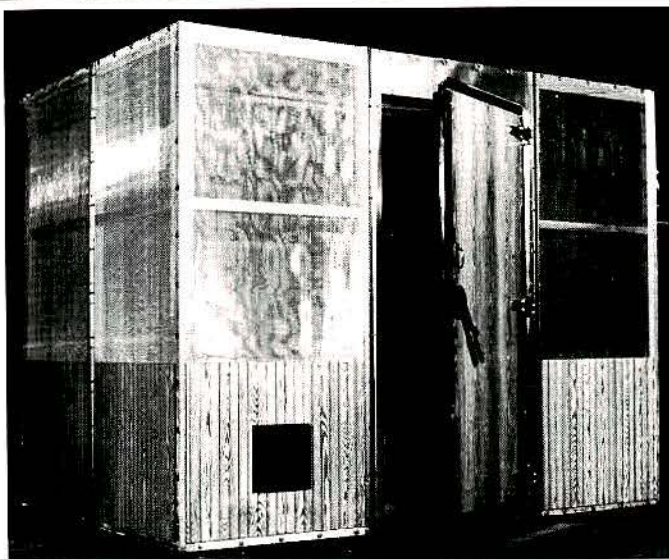
Our application engineers will help you design enclosures that meet your requirements for windows, filters for power and signal lines, wave guide feedthrus, and lights.

Other options include RF connectors, fiber-optics, special access panels, automatic doors, emergency exits, permanent ramps, and flush floors with low-rise thresholds.

EASY MODULAR ASSEMBLY

Our patented resilient clamping system permits easy assembly. Enclosures can be modified and relocated again and again without compromising performance.

Lindgren also designs and builds a variety of shielding solutions for industrial, medical, military, and scientific applications.



ONLY LINDGREN MODULAR SHIELDING SYSTEMS ARE ASSEMBLED, TESTED, & GUARANTEED TO MEET SPECIFICATIONS BEFORE THEY'RE SHIPPED.

Call us for more information and applications assistance.
708-307-7200



**LINDGREN
ENCLOSURES**

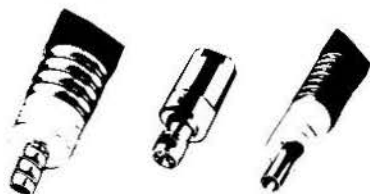
400 High Grove Blvd.
Glendale Heights, IL 60139
Phone: 708/307-7200
FAX: 708/307-7571

Circle (70) on Fast Fact Card

SANTA FE

distributing

FOR ALL YOUR CELWAVE PRODUCTS



CELLFLEX® Closed cell foam dielectric with low density & high velocity

AVAILABLE IN

1/2" 7/8" 1 5/8"

LLFLEX® Foam - stranded inner conductor, excellent flexibility, low loss

AVAILABLE IN 1/2"

**SANTA FE CAN
CUT TO LENGTH &
INSTALL CONNECTORS
REELS or BOXES**

**FULL LINE OF
CELWAVE **

**BASE ANTENNAS
MOBILE ANTENNAS
DUPLXERS**

**SANTA FE distributing
800-255-6595**

14400 West 97th Terrace
Lenexa, Kansas 66215
913-492-8288 Local
913-894-2136 Fax

**WE CAN FILL YOUR
NEEDS WHETHER
LARGE OR SMALL**

Feedback

Unlicensed operation haunts marine radio

Unlicensed operation on marine radiotelephone channels is one of the biggest culprits facing legal operators, according to respondents to the October 1991 "What Do You Think?" questionnaire. Readers cite myriad problems faced in marine communications:

- "Poor antenna choice and installation; do-it-yourself installations; too many cheap and low-quality brands; difficulty in obtaining parts promptly; and channel 16 is overcrowded."
- "Illegal operators running on the airwaves for business and pleasure."
- "Lack of FCC licensed technicians for marine repair."
- "Mail order competition results in improper installations."
- "Most people don't want to go through licensing."
- "The pirate stations and 'bootleggers.'"
- "Stores such as Radio Shack and mail order enterprises that sell units to anyone—no license check."

Important functions for marine radiotelephones include adjustable watt output, direction finder and priority scan, respondents report. Readers indicate that an auto-alarm, clock, auto ID and scramblers are additional essential functions for marine radios.

Marine radiotelephone equipment improvements readers favor include:

- "Automatic call sign ID requirement and licensed radio dealers."
- "Higher audio outputs in order to hear transmissions at high speeds."
- "Priority scan to emergency channel and weather alert."
- "Selective calling for fleets that is a standard, inexpensive accessory."

Readers opinions of the maritime radio service contrast. Some claim the service is good, while others believe the service is poor. Problems such as unlicensed operation in the marine bands and poor-quality equipment contribute to the negative impression of the service.



When You Need Rechargeable Batteries...

MAKE THEM JABRO!




Whatever your battery needs... paging, communications, public safety, emergency lighting or other applications... you can rely on JaBro as your **NUMBER ONE SOURCE** of supply. You will get fast delivery on these factory-fresh, high quality American made, nickel-cadmium batteries... with the power built-in for peak performance.

Our expanded line is detailed in this 16-page catalog, complete with cross reference data and specifications. See for yourself why so many rely on JaBro - The House of Batteries - as their primary source.

Write, phone or FAX today for our catalog.

JABRO Is A Factory Authorized

Value Added Center For 



JABRO Batteries, Inc.

1938-A University Lane, Lisle, IL 60532
Phone: 708/964-9358 • FAX: 708/964-9081
Telex: 281024 • Cable: JABROUSA
ORDER ENTRY: 800/323-3779 • FAX: 800/237-6435

JABRO Batteries S.W., Inc.

25700 I-45 North, #111, Spring, TX 77386
Phone: 713/367-9393 • FAX: 713/292-7139
ORDER ENTRY: 800/245-1138

Canadian Affiliate: 403/248-4020 • European Representative: (33)-1 43.00.94.94

Gary Bolen advances from director of sales and marketing to executive vice president of U.S. operations for Tait Electronics, Houston.

Rick Rowder leaves Motorola, Schaumburg, IL, as financial manager for car telephone and microwave products, to join Hutton Communications, Dallas, as controller.

Morton L. Topfer, executive vice president of Motorola and president of its land mobile products sector, adds membership on the board of directors at Racotek, Minneapolis, to his responsibilities.

Dennis Dyer leaves his post as president of Plug Compatible, a computer products company in Chicago, to become account manager of electronic distribution for Tripp Lite, Chicago.

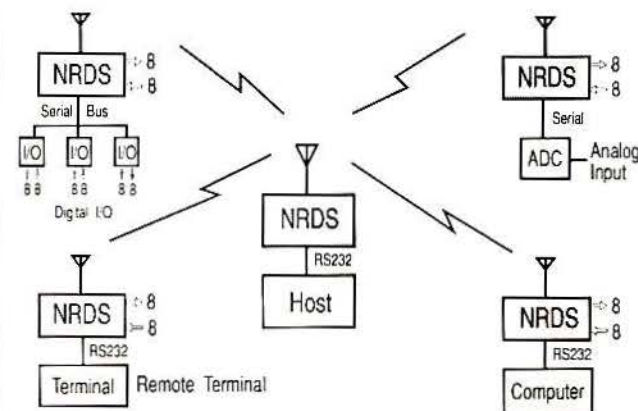
Fred M. Link adds Ericsson GE, Lynchburg, VA, as a client for his consulting services. Link is *MRT's* industry consultant.

Robert E. Levy exits Antenna Specialists, Solon, OH, as vice president of national sales to form REL and Associates, a sales and consulting company in Solon.



NETLINK Radio Data System

- Integrated packet-radio modem and high quality data transceiver
- Data rates of 1200, 4800, 9600, or 19200 baud
- Serial and parallel I/O
- Many applications including remote telemetry



GLB ELECTRONICS, INC.

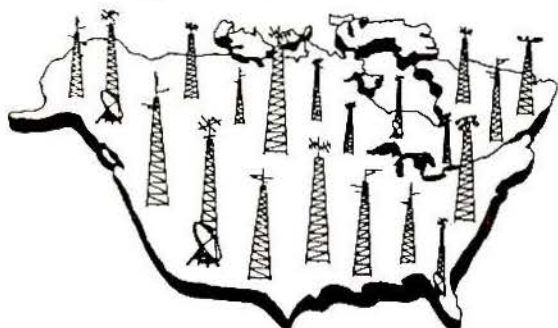
151 Commerce Pkwy., Buffalo, NY 14224
Tel: 716-675-6740 Fax: 716-675-6742

Circle (73) on Fast Fact Card

TITAN™

O W E R S

*are sprouting up
all over North America*



Available up to 96', TITAN self-support towers offer an unbeatable combination of quality and versatility at a price that makes them an outstanding value.



P.O. BOX 185, 21 HOWARD AVE. ELMIRA, ONT. CANADA N3B 2Z6
TEL (519) 669-5421 FAX (519) 669-8912

Circle (74) on Fast Fact Card

SONIC Sound Technology Working for You

SONIC Helmet Kits allow Hands Free Communications for the helmeted officer; riding a motorcycle, mounted on horseback, or dressed in full riot gear. SONIC Helmet Kits fit existing helmets with no modifications required and interface with today's most popular radios.



**CALL OR FAX
FOR MORE
INFORMATION ON
SONIC PRODUCTS**

Sonic Communications Inc.
4 Colonial Center Box 287
New Ipswich N.H. 03071 USA
Tel: 603-878 1944 Fax: 603-878 1773



Circle (75) on Fast Fact Card

East Police	West Police	Central Police	Channel Selection
01 IndianaM Vote	23 MiamiHts	45 WilkesM Receive	East/West/Central Emergency Voice/White
02 WilkesM	24 Calhoun Receive	46 Grubbs Receive	
03 Glendale Receive	25 Cheviot	47 Engineer Receive	Combined Technologies Inc. Remote Comparator Display
04 CommCtr	26 CommCtr Receive	48 Glendale Vote	
05 Loveland	27 Mt Echo	49 Calhoun Fail	Mouse Buttons Left - Force Vote Right - Disable
06 Sweetme Receive	28 MiamiM	50 CommCtr Receive	
07 Anderson	29 Grubbs Vote	51	
08 Grubbs	30 Cleves	52	
09 Engineer	31 Fernside	53	
10 Wilford Receive	32 Grubbs Receive	54	
11 Mariemont	33 Mt Joe	55	
12 Calhoun Disable	34 Engineer	56	
13	35 Hamilton Receive	57	
14	36 Harrison Receive	58	
15	37	59	
16	38	60	
17	39	61	
18	40	62	
19	41	63	
20	42	64	
21	43	65	
22	44	66	

Remote Comparator Display

The Smartswitch II™ Remote Comparator Display monitors and controls voting receiver activity on a color CRT or console. It can be used remotely or locally.

Now you can *get control* of your voting system.



Combined Technologies, Inc.
(513) 595-5900

Circle (76) on Fast Fact Card

ARE YOUR STANDBY BATTERIES SITTING DOWN ON THE JOB?



COMMUNICATION SITES AS WELL AS EMERGENCY VEHICLES DEPEND ON BACK UP BATTERIES TO TAKE OVER IN CASE OF POWER FAILURE OR TO START AN ENGINE AT A MOMENT'S NOTICE.

NEWMAR'S MAINTENANCE CHARGERS AUTOMATICALLY MONITOR MULTIPLE BATTERY BANKS KEEP THEM IN PEAK CONDITION. THE SYSTEM CAN BE LEFT UNATTENDED FOR EXTENDED PERIODS WITHOUT BATTERY DAMAGE, SAVING ON BOTH COSTLY SERVICE CALLS AND BATTERY REPLACEMENT.

THE RUGGED ANODIZED ALUMINUM CASE WILL SURVIVE THE RIGORS OF PERMANENT VEHICLE MOUNTING OR BEING BOLTED TO THE WALL OF A REMOTE COMMUNICATION SITE.

USE NEWMAR CHARGERS AND THE CONDITION OF YOUR BATTERIES WILL BE ONE LESS THING FOR YOU TO WORRY ABOUT.

NEWMAR
RELIABILITY BEYOND COMPARE

NEWPORT BEACH CA
PHONE: (800) 854-3906
FAX: (714) 957-1621

Circle (77) on Fast Fact Card

May

7-9—1992 Annual Mobile Communications Conference, Westin ANA Hotel and Resort, Washington, DC. Contact: National Association of Business and Educational Radio, 800-759-0300.

11-13—Vehicular Technology Conference, sponsored by IEEE Vehicular Technology Society, Hyatt Regency, Denver. Contact: John Tary, 303-452-6111, ext. 443.

13-15—Radiocomm Annual Convention, Montreal. Contact: Lisa La Prairie, 613-233-4888.

17-20—East Coast Regional Conference Associated Public-Safety Communications Officers Meeting, Lancaster Host Resort, Lancaster, PA. Contact: James Giannini, 215-631-6500.

June

17-19—Virginia Tech Symposium on Wireless Personal Communications, Virginia Tech, Blacksburg, VA. Contact: Jack Lilly, 703-231-4849.

21-25—Utilities Telecommunications Council 44th Annual Meeting, Hyatt Civic Plaza, Phoenix. Contact: Rita Clark, 301-621-7802.

July

19-23—Forestry-Conservation Communications Association, Toledo, OH. Contact: Don Pfohl, 602-644-3166.

August

9-14—Associated Public-Safety Communications Officers 58th National Conference, Washington State Convention Center, Seattle. Contact: 800-824-1850.



Cellular carrier info... as close as your computer!

THE MSA/RSA DATABASE

The same information you have come to rely on in *Cellular Business* magazine's "Calling All Carriers" in the May issue is now available on computer diskette. This directory includes carrier names, addresses, telephone numbers and fax numbers (when available) of the 306 metropolitan statistical areas (MSAs) and 428 rural service areas (RSAs). The directory is available in ASCII format so that it can be adapted to any computer program. Complete on one diskette.



**EACH DISKETTE
COSTS ONLY
\$25**

Call 800-543-7771 to order, or mail us this form.

Cellular
BUSINESS

Cellular Business Products
Attn: Joan Jackson
P.O. Box 12901
Overland Park, KS 66282-2901

Please send _____ copy(ies) of the Database @ \$25

\$ _____ Enclosed Add \$5 for shipping and handling.
Outside North America, add \$15.

Name _____

Company _____

Street (No P.O. Boxes) _____

City _____ State _____ Zip _____

THE PORTABLE DEPOT, Inc.
SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE

- FACTORY TRAINED TECHNICIANS •
- SURFACE MOUNT TECHNOLOGY •
- FACTORY APPROVED NATIONWIDE •
- PUBLIC SERVICE TRUNKING •
- VOICE GUARD CERTIFIED •

• MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS •

 Route 2, Box 338C • Lynchburg VA 24501
804-237-3427

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936

PORTA-TECH PORTABLE TECHNICAL SERVICE, INC.

1106 Laxton Road • Lynchburg, VA 24502

 **GE Portable Radio Service Depot**
Factory Approved Nationwide

- Current Product Lines
- Voice Guard Certified
- Public Service Trunking
- Surface Mount Technology

FACTORY TRAINED TECHNICIANS FOR QUALITY SERVICE

(804) 239-3049

TCS

Jerry L. Simmons
Communications Systems Consulting
Land Mobile & Microwave Systems

P.O. Box 884 Montgomery, TX 77356 Ph (409) 588-3200
Fax (409) 588-4434

COMMUNICATIONS CONSULTING SERVICES

RAM

10 Woodbridge Center Drive Woodbridge, NJ 07095
(908) 636-6970
Toll-Free: (800) 247-4796 • FAX: (908) 636-7260

COMMUNICATIONS CONSULTANTS, INC.

Offices In: Albany, NY, Alexandria, VA, Boston, MA, Detroit, MI, Ft. Lauderdale, FL, Honolulu, HI, Houston, TX, Phoenix, AZ, Richmond, VA, San Diego, CA, London, England.

LIGHTNING PREVENTION SYSTEMS 


STATIC DISSIPATION AND GROUNDING SYSTEMS FOR COMMUNICATIONS TOWER SITES

204B Cross Keys Road, Berlin, NJ 08009
FAX 609-767-7547 • (609) 767-7209
Don't Wait Until It's Too Late!

Communications Technology Associates
A Division of Hayes, Seay, Mattern & Mattern, Inc.

PLANNING AND DESIGN: PLUS:

- 2-Way Radio
- M & F/O
- CAD/MOT/AVL/Paging
- Complete A&E Services
- Bldgs, Towers, Pwr Sys
- Structural Engineering

 Box (804) 239-9200 P.O. Box 4579
FAX (804) 239-9221 Lynchburg, Virginia 24502

SHAFFER & ASSOCIATES, INC.
Consulting Engineers

LAND MOBILE / MICROWAVE
System Design Propagation Analysis
RFP/RFQ Analysis Type Acceptance Testing
Bid Specification Development

TOM L. DENNIS, P.E.
3050 Post Oak Blvd., Suite 1700
Houston, Texas 77056
Tel. (713) 621-4499 Fax. (713) 621-5751

SFA INC. (301) 925-9400
(800) 787-2732
Fax (301) 925-8612

Telecommunication & Information Science Division

Public Safety, Transit, Government & Industry

CORPORATE OFFICE
Donald P. Nowak 1401 McCormick Drive
Manager Landover, Maryland 20785

Invest your Advertising Dollars where your Prospects Invest their Time...

MOBILE RADIO TECHNOLOGY

 **OMNICOM, Inc.**
COMMUNICATIONS ENGINEERING

GENE A. BUZZI
PRESIDENT

401 THE MANULIFE PLAZA, SUITE 2001
TALLAHASSEE, FL 32302-3009
OFFICE (904) 294-2451

Nationwide Communications Services

238 East 23rd St., New York, NY 10010
212-686-8089 Fax 212-679-9152

- \$25/hr. Portable, Mobile (2 hr. Max.)
- \$8 Flat Rate Labor Plus Parts for Page
- Quick Turnaround and 90 Day Warranty
- MOT, GE Part List. All Defective parts Returned
- Refreq., Recode and Repair Contracts Available
- All Technicians are MOT, GE Trained
- Over \$100 Gives You Estimate Call & Return UPS Pay

 **FREDERICK G. GRIFFIN, P.C.**
3229 WATERLICK ROAD
LYNCHBURG, VA 24502
TEL: (804) 237-2044 / FAX: (804) 237-8063

NATIONWIDE COMMUNICATIONS CONSULTING
MOBILE RADIO, MICROWAVE, ES-1-1
CAD, PAGING, LAN
DISPATCH COMMUNICATIONS CENTERS
MULTI SITE PROPAGATION ANALYSIS

Communications Engineering Services, P.C.

Coverage Predictions • Terrain Analysis
Propagation Studies
Computerization of Manual Engineering Systems
Site Selection • Frequency Allocations
FM, TV, Land Mobile, Cellular, Paging Services

Richard L. Biby, P.E.
6105-G Arlington Blvd. Falls Church, VA 22044 USA
(703) 534-7880
Fax: (703) 534-7884 root@comm-data.com

MCCON


Mobile Communications Consulting
S. R. McConoughy, P.E.
Principal

13017 Chestnut Oak Drive
Gaithersburg, MD 20878 (301) 926-2837

GET THE EDGE OVER YOUR COMPETITOR

ADVERTISE IN
MOBILE RADIO TECHNOLOGY CLASSIFIEDS

Call Carla Gamino at
303-762-1249 Fax 303-762-0069

 **RAYMOND C. TROTT CONSULTING ENGINEERS, INC.**
1425 GREENWAY DRIVE, SUITE 350
IRVING, TEXAS 75038
214/580 1811

RAYMOND C. TROTT, P.E.
PRESIDENT

LAND MOBILE - MICROWAVE COMMUNICATIONS SYSTEMS

YOUR CARD HERE

reaches 43,230* prospects
for as low as \$76 per insertion.

Call Carla Gamino
303-762-1249
FAX 303-762-0069

*Baxter Research Corporation

C lassified

Advertising rates in **Mobile Radio Technology's** Classified Section are \$69.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4 inch.

Blind box ads (replies sent to **MRT** for forwarding) are \$30.00 and Fast Fact reader service numbers are available for \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by **MRT** on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Carla Gamino at (303) 762-1249 or fax (303) 762-0069 to place your classified ad. Or send your advertising materials and order to Lisa Cunningham, **Mobile Radio Technology**, Classified Advertising Department, 9221 Quivira Rd., Overland Park, KS 66215.

Help wanted

TWO-WAY TECHNICIANS

GLOBE, ARIZONA: MSS SHOP IS LOOKING FOR TWO-WAY TECHNICIANS EXPERIENCED IN ALL MOTOROLA EQUIPMENT, INCLUDING PAGERS, PORTABLES, MOBILES, REPEATERS, BOTH CONVENTIONAL AND TRUNKING, NEW AND OLD.

WORK INCLUDES: BENCH REPAIRS, FIELD REPAIRS, TOWER WORK, AND INSTALLING.

MUST BE FCC LICENSED, NABER CERTIFIED OR EQUIVALENT.

PLEASE SEND RESUME TO OR CALL:

ROY D. HUDGINGS
SHORES COMMUNICATION CO., INC.
P.O. BOX 2626
GLOBE, ARIZONA 85502
PHONE: (602) 425-5870

OREGON

Looking for experienced salesperson willing to move to the beautiful Pacific Northwest. Must have 2-way radio experience. Only those with radio sales background need apply. Equal Opportunity Employer. Send resume to:

Personnel Manager
P.O. Box 22169
Milwaukie, OR 97222

TWO-WAY TECHNICIAN

Small Central Minnesota Motorola Dealer/MSS is seeking an experienced field/bench technician. Position requires a self motivator, with good communication skills, who can work independently. Good working conditions with excellent equipment. On-going training for emerging/evolving technologies. Salary commensurate with experience. Health insurance, vacation, and vehicle included. Experience Minnesota's vacationland at your doorstep!

MARTIN COMMUNICATIONS
109 - 2nd Avenue Northeast
Brainerd MN 56401
218-829-6007

Help wanted

Trade Magazine Technical Editor

Expansion has created excellent opportunity for cellular/RF expert to work on top technical publication in cellular field. Will write articles on technical aspects of cellular business, edit materials from outside authors and manufacturers, and offer technical assistance and expertise to other publications within group. Must have understanding of mathematics and technical graphics sufficient to handle the cellular radio subject matter covered. Technical degree preferred. Send complete resume and salary requirements to: **Mobile Radio Technology**, P.O. Box 12901, Dept. 916, Overland Park, KS 66282. EOE M/F/H

IMMEDIATE OPENING

Growing MSS in West Tennessee needs experienced Motorola Tech.

Get out of the **Big City Rat Race Now.**

Contact: **Chris Young**
West Tennessee Comm.
1295A Hwy 51, Dyersburg, TN 38024
(901) 286-6275

WAVETEK

Cellular Test Sales Mgr. Midwest. Manage 12 U.S. reps. Req: tech degree, 3 yr. Sales Mgt., Com, 2 way, cellular exp. (619) 279-2200 - x564. 9145 Balboa Ave. S.D. CA 92123 EOE.

CELLULAR OPPORTUNITIES

National openings for experienced Cell Site Techs, Switch Tech, and other **TECHNICAL PERSONNEL** at all levels within Cellular Communications. Locations in a number of markets.

LAWRENCE PERSONNEL

1000 Valley Forge Circle
King of Prussia, PA 19406
215-783-5400; 215-783-6008 (FAX)
COMMUNICATIONS RECRUITMENT SINCE 1957.

PAGER TECHNICIAN

Experience on Motorola and NEC needed. Salary commensurate with experience. Full benefits. Send resume and salary history to:

McManus Communications
400 North 5th Street
Blytheville, AR 72315
501-763-6250

Business Opportunity

...BUSINESS FOR SALE...

M.S.S.—11 Yrs. of established business success

- 3 Mountain Top Sites
- Paging System
- Cellular Phones

Sales & Service of all Major Comm. Equip.
Located in So. West Wyoming

CALL JUDY 307-789-2058

Equipment for sale

USED 2-WAY RADIOS

Call Sid Cohen

at **AIR COMM—Phoenix, AZ**

(602) 275-4505 • Fax (602) 275-4555

30%-70% savings on Motorola, GE, EFL mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "Systems 90" control heads. **PL and paging needs**, channel elements. Cash quotations made for purchase of above equipment.



4614 E. McDowell Rd.
Phoenix, AZ 85008

STANDARD HX400

- 25 Channel VHF Portable
- Scan w/Priority, LCD
- Rapid Charger & Battery
- Programmed at NO CHARGE!
- Used - Good Condition

ONLY \$299!

VersaTel

1-800-456-5548 Fax 307-266-3010

The PoVch

Tough.....
resilient.....
black neoprene

More than
100 DEALERS
Have a fit

About \$11.00

A sturdy web belt-loop sewn on the back extends over the top and is secured on the front with a velcro tab.

The PoVch

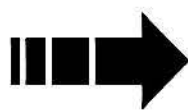


It's Washable!

1-800-72-Pouch (Dealer Information)

RECONDITIONED
MOTOROLA RADIOS
California
Radio ➡ 800-231-0103

Equipment for sale



Radius



- ☉ LOWEST possible prices!
- ☉ BEST units on the market!
- ☉ IMMEDIATE delivery!
- ☉ FREE programming!
- ☉ FREE re-programming!
- ☉ HUNDREDS in stock!



CALIFORNIA RADIO®

16943 - 6200 Road Montrose, COLORADO 81401

*We Want
YOUR business!*

ORDERS: 800-231-0103 QUESTIONS: 303-249-1414 FAX: 303-249-4334

CLOSE OUT

RATELCO 12A-48V CHARGERS
Some new... \$500 ea.

2 GHZ GTE LINKHURT MODEL
79F1-02 1 HOP + Spare
\$1,500

2 EA. MSF-5000 UHF - C24CLB7106A

WANTED

FARINON LRI-2

PHONE **818-308-0398**

FAX **818-308-3909**

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR

\$25 - \$35!!!

ORDERS ONLY:

1-800-237-6519

INQUIRIES AND IN LA:

504-361-5525

- ☐ Motrac; Micor, Mocom; Mitrek; Etc.
- ☐ MT's, and GE Elements. Call for prices.
- ☐ Any desired Frequency available for fast delivery.
- ☐ Lifetime Warranty on Crystals
- ☐ Trade-in credit on your Old Channel Elements
- ☐ We Buy Used Elements

Try us first. We always have your frequency available.

NKX

1814 Hancock St.
Gretna, LA 70053

BUY — SELL — TRADE

Micor Base/Repeater from \$1295
Master II Base/Repeater from \$1295
Mocom 70 Consoles from \$250
Mocom 70 Mobiles from \$100
Micor Mobiles from \$150
Mitrek Mobiles from \$150
Maxar, Radius, Traxar Mostars from \$150
Master II Mobiles from \$150
EX II Mobiles from \$100
Phoenix/Centura/MVP from \$150
DC/Tone Remotes from \$100
Pulsar I/III VHF/Bell from \$395



Bob Barnett
Owner WSRH/L
FCC 1st Class Tech
30 Years in
Communications

Bases/Repeaters/Mobiles
No Used Pagers-Portables or Parts
Cash + Shipping Paid Promptly
Call For Quote or Sales List
Warehouse 1-501-835-7066
Fax 1-501-835-8766

BARNETT ELECTRONICS

8718 Wilhite Lane • North Little Rock, AR 72120

Hy-Q

International (USA)

- ☐ **PAGER CRYSTALS**
- ☐ **COMMUNICATION CRYSTALS**
- ☐ **CHANNEL ELEMENTS**
 - Recrystallized
 - Compensated
 - Complete Elements

(606) 283-5000
FAX: 1-606-283-0883

1438 Cox Ave., Erlanger, KY 41018
(Greater Cincinnati Area)

"Precision Quality Quartz Crystals
Made to Your Specifications"

48-HOUR SERVICE AVAILABLE

Circle (85) on Fast Fact Card

Swersweep SWR Measurement Kit

Swersweep is designed to work with modern service monitors with tracking generator and spectrum analyzer enabling a plot of SWR vs. Frequency on the CRT display. Swersweep allows the instrument to function as a scalar network analyzer. See feature article on page 64 of October 1989 *Mobile Radio Technology* for more information.

Uses:

- Tuning Antennas: Base, mobile, or glass
 - Tuning cavities, duplexers, or filters
 - Tuning preamps and Receiver front ends
 - Checking transmission line and trimming to resonance
- Each Swersweep is hand built with calibration traceable to the National Bureau of Standards.

1-500-Mhz. \$350. 1-1000 Mhz. \$675
Prices include shipping.

Europa Marketing

2358 S. Patterson Mesa, AZ 85202
Phone: 602-345-6666

WHY SETTLE FOR ANYTHING LESS

New Motorola and NEC Pagers



BRAVO

One call can get it all...

- Competitive Prices
- Quantity Discounts
- Many Types Available

Also available:

- Reconditioned Pagers
- Recrystal code plugs
- Refurb Kits
- Batteries
- Parts

WE BUY PAGERS

McManus Communications

400 N. 5th
Blytheville, AR 72315
501-763-6250
FAX: 501-763-6533



Circle (86) on Fast Fact Card

GENERAL COMMUNICATIONS

MOBILE COMMUNICATIONS
AUTHORIZED DEALER

#1 GE DEALER IN THE USA!

Largest Inventory — Quality Service

Fastest Delivery and Best Prices



1-800-356-3200

5157 Anton Dr.
Madison, WI
53719

Circle (87) on Fast Fact Card

"CONFUSED"

ABOUT WHAT LABEL COMPANY TO CHOOSE?

We are one of the oldest pager label companies recommended and used by the leading pager manufacturers in the country.

We make the label that you need to your specifications.
PAGER — TWO-WAY — CELLULAR — AND MORE!

Send for samples and a FREE sample of
Clean-A-Page (label remover & cleaner).

Anchor Graphics

1467 LeMay Suite 111 • Carrollton, TX 75007
214-242-0439 / FAX 214-242-0959

Why settle for anything less than what you want!

Motorola/Radios Upgrades and Conversions

Upgrade your existing Conventional AND Trunked
equipment with:

Additional Modes,
Scan, Signalling Systems and
"Out of Band" Frequencies.
16 Channel/Scan Conversions for
GP-300 \$34.95

Standard Programming and Repairs also available



RadMax Communications

COMPLETE COMMUNICATIONS SERVICE

10677 Indianwoods Drive, Cincinnati, Ohio 45242
513-489-1732

CLEAN MOTOROLA RADIOS

MOBILES & PORTABLES 800 MHZ TRUNKED	
15W TRAXAR W/ACCESSORIES	\$250.00
15W MOSTAR	\$395.00
35W MOSTAR ATM	\$450.00
35W SYNTOR x2 OR x3	\$250.00
35W SYNTOR x 15 SYS/15 SUB/CONV NEW	\$995.00
35W PP1000 OR PP500x	\$995.00
2W MTX800 . \$645.00 MTX810 6 SYS/CONV	\$795.00
1W STX W/CHRG \$695.00 3W STX W/CHRG	\$995.00
BASE STATION PACKAGE P/S. DESK-MIC	\$200.00
PRIVACY PLUS DESK SET	\$150.00

MOBILES & PORTABLES 900 MHZ TRUNKED	
12W B2 MAXTRAC \$595.00 30W B7 MAXTRAC	\$695.00
12W B2 SPECTRA \$695.00 12W B5 SPECTRA	\$795.00
30W B5 SPECTRA \$895.00 30W B7 SPECTRA	\$995.00
2W MTX900 B3 & B4 6 SYS/3 SUB/CONV	\$895.00

CONVENTIONAL RADIOS	
60W VHF MITREK 4F PL \$395.00 110W 4F PL	\$495.00
30W UHF MITREK 4F PL \$275.00 100W 4F PL	\$495.00
35W MITREK 800 MHZ 4F PL	\$275.00
30W SPECTRA 900 MHZ "B5"	\$695.00
50W UHF SYNTOR 8F PL	\$395.00
60W MAXTRAC 2F 30-35 MHZ	\$395.00
100W UHF MICOR 4F PL	\$150.00
25W UHF MAXTRAC 16F \$495.00 40W 16F MAX	\$595.00
4W HT440 UHF 472 MHZ PL CLEAN	\$250.00
5W MX350 8F 1A PL RAPID CHARGER	\$195.00
75W MSF5000 DUP MPL TEST PAN	\$3,995.00

SPECIALS

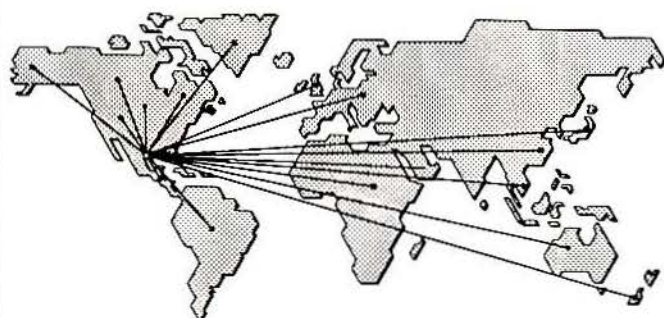
*15W MAXTRAC TRUNK 800 07 10 SYSTEM	\$595.00 *
* 15W SPECTRA B5 800T \$995.00 35W B7	\$1,295.00 *
* 72 CHAN VHF SABER 11/DVP NEW	\$1,195.00 *
* 120 CHAN UHF SABER111/DVP CAP	\$1,495.00 *
* 99 CHAN VHF MT1000 W/SCAN	\$895.00 *
* 100W SYNTOR x UHF 8F MINT	\$995.00 *
* 100W SYNTOR x 9000 UHF	\$1,495.00 *
* DATA I/O W/UNIPAK 2B AS NEW	\$2,500.00 *
* 23 GHz STARPOINT TELEMETRY 23 AT	\$2,500.00 *

WE BUY STX-MTX-MAXTRAC-MITREK-MT1000-SABER
SYNTOR 9000-MOSTAR-MSR2000-MSF5000-SPECTRA
NO ONE IN USA HAS LOWER NEW RADIO RATES PRICES
RADIO EXPRESS 703-266-1928 FAX 703-830-8710

Circle (88) on Fast Fact Card

PAGING PRODUCTS INTERNATIONAL, INC.

9829 Telephone Road Houston, Texas 77075



ANY CONTINENT
ANY COUNTRY

ANY STATE
ANY CITY

**Whatever Your Size or Requirements
We Are Here to Provide Your
Paging Products**

FOR MORE INFORMATION, PLEASE CALL:

1-713-991-4930

1-800-628-3910

Fax : 713-991-4948

1-800-966-1766

Fax : 214-203-1766

Dealer Inquiries Welcome

Circle (89) on Fast Fact Card

MULTI LINE SELECT

**Connect All Your
Base Stations to
ONE Remote!!!**

- Tone Remote with up to 8 Channels (F1-F8)
- Select up to 8 Base Stations
- Electronic Rotary Switch for Line Selections
- LED Line Activity Indicators
- Monitor all Capability
- Add or Delete any Combo of Receive Audio
- Amphenol Connector & Cable Supplied



Automation &
Electronics
Engineering, Inc.

13667 Floyd Circle
Dallas, TX 75243
800-527-4596
800-383-9180 FAX

Circle (90) on Fast Fact Card

Equipment for sale

BUY SELL

Used GE-MARC
Trunking Radios.

TMX 8310 TMX 8210
TMX 8510 TMX 8712
TMX 8825 TMX 8615

Call
**John
Peacock**

Tel. 800-232-7715
Fax 501-735-7799

Circle (91) on Fast Fact Card

RADIUS P10

★low-low-low-low★

MOSS COMMUNICATIONS
1-800-767-1963

PA1/PA2

MOTOROLA RADIO PROGRAMMING ADAPTORS

- IBM AT/XT compatible
- Supports full spectrum of programmable Motorola radios
- Includes AC wall adaptor, XT/AT adaptor cable, serial extender cable, manual, 1 year warranty

PA 1 \$169.00

Program Your Radios IN-HOUSE

- Additional Features of PA 2
- Rechargeable Ni-CADs
- On/Off switch & Charge LED
- Data Transfer light

PA 2 \$195.00

Order By 1 PM & We'll Ship That Day
1-800-752-3571

GP-300

SCC

Southern Computer Corp.

141 W. Wileuca Rd. • Suite 300-B • Atlanta, GA 30342-3219 • 404-252-3340 • FAX 404-252-8929

Circle (92) on Fast Fact Card

BUYING ERICSSON - GE EQUIPMENT CALL OR FAX FOR QUOTE

Maxar 42-40 DS1TSA4300 55W	\$125
Maxar 150-174 D43TSA1900 50W	100
Mocom 70 accessories only	30
CMX-8630 conventional 800 mhz	275
CUSTOM MVP, VHF w/acc.	125
Delta-S 150-174 no acc. 110W	275
Phoenix-SX UHF 16 ch w/acc.	225
Phoenix-SX VHF 16 ch w/acc.	225
MASTR II 150-174 110W, from	115
MPI port. 4W eg 150-174 new	225
MPI port. 2W eg 150-174 new	195
MPI port. 2W eg 136-153 new	195
MPI port. 4W eg 150-174 new	195
MASTR II VHF "E" package, 110W	
DFE W/C500 scan accessories	225
S-990 128 ch head w/warranty	125
New Cellular Handsets & Options	Call
MPS/MPR/MPX/MPI/MPD Chargers	Call

NEW LONDON TECHNOLOGY

231 Old Timberlake Road
Forest, Virginia 24551
TEL 804-525-0068 FAX 804-525-0078

ACTIVE FILTERS AND REEDS

FOR MOTOROLA PAGERS
FAST DELIVERY

Bramco.

PH (513) 773-6255

P.O. BOX 1482, PIQUA, OHIO 45356

100W VHF MICOR CONT DUTY
C73RCB-3125B BASE W/PL
W/TONE REMOTE - \$1000.00
(512) 271-9766 Lv Msg.

Rocks

Crystals For Pagers & Radios

- Lifetime Guarantee on Bomar Crystals • Competitive Pricing
- 48 Hour, 1 Week and 2-3 Week Service

Call 800-526-3935 • Fax 800-777-2197

201 Blackford Ave.

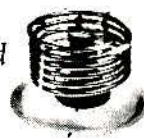
BOMAR

Middlesex, NJ 08846

Circle (95) on Fast Fact Card

UAntenna

Low Profile • Low Band
Antenna for Radio
Communication



FEATURES:

- Up to 95% Height reduction
- Easy Installation
- High Performance • Low Cost

Model CR109A
**THE ULTIMATE
LOW BAND**

COM-RAD INDUSTRIES
PO Box 554, Grand Island, NY 14072
For Immediate Fax Info & Technical Assistance,
Telephone: 716/773-1445

GE MASTR-II LB/VHF 100W Mobiles	\$135 ea.
GE MASTR-II VHF 45W Mobiles	\$75 ea.
GE MASTR-EXEC II UHF Mobile 75W	
w/MASTR II Access.	\$195 ea.
GE EXEC-II VHF 75W	\$135 ea.
GE EXEC UHF Base w/PL	\$175 ea.
GE MASTR II Cables and Mics	\$20 ea.
GE 2c/5c Elements	\$15 ea., EC \$5 ea.
MICOR C73RTB Paging Station, MODAX 500	\$750 ea.
MICOR VHF 45W	\$85 ea.
MICOR LB 100W	\$135 ea.
MOXY UHF w/PL D346MA	\$165 ea.
MOT HPN1004A Base Supply	\$95 ea.
MIDLAND 70-340 Mobile	\$165 ea.
UHF Duplexor, Rack Mount	\$250 ea.
BIRD PEP METER	\$165 ea., Varied Slugs \$35-\$50 ea.
MOT SYNTOR 35W UHF w/Tone w/Access	\$235 ea.
MOT MITREK 100W LB w/Tone	\$195 ea.
GE EXEC-II Base F15KFG88A w/Access.	\$250 ea.
GE MASTR-II 100W VHF Base	\$1500 ea.
MOT Trunked MOSTAR w/DTMF	\$285 ea.

ALL RADIOS BENCH CHECKED UNLESS NOTED
Call Dave — 405-634-5600 405-634-9500 Fax

Now, here's a switch!

CHARGE GUARD®

automatic ON/OFF timer switch
for two-way radios, cellular phones

EASY TO INSTALL.

NO IGNITION SWITCH CONNECTION!

PROGRAMMABLE.

15 MINUTES TO 15 HOURS!

Prevents Dead Batteries.

MADE IN U.S.A.
PROTECTS YOUR RADIO.

SUGGESTED LIST PRICE **ONLY \$74.95** MODEL CG1B-12W

12 AND 24 VOL. 1 MODELS AVAILABLE

CALL NOW FOR MORE INFORMATION!

ASK ABOUT
OUR NEW
DEALER KIT!

CHARGE GUARD

400 Highland Avenue
Allentown, PA 16602

800-458-3410



Circle (93) on Fast Fact Card

Equipment for sale



P. O. Box 7846

Fredericksburg, VA 22404

(703)373-3888

Portables

P43XS Series DES Portable Repeater
P106B MX Portable Repeaters
Multi FXL Portable Repeaters
PT500 Low Band P1010 VHF MX Packsets
PM10s VHF and UHF
Chargers MX's STX's HT90/440, HT's, GE's and More
APCORS and Accessories

Mobiles

Syntor and Syntor X UHF and VHF
DVP UHF Micors
DVP Syntor X VHF
MCX 100s VHF

Bases

D74RAU13A 30-36 ID CG 110w

Deltas LB and VHF
HFSS8 Triton
Memcoms Full Duplex

Visit our shop at 1003A
Tyler Street in Fredericksburg.
Direct all correspondence to our
P.O. Box.

C71RCB3146C 36-42 CD PL 100w
C71RTB 3493 42-50 ID PL 110w
C53RTB3125C 150-162 ID PL 60w
C73RTB1106E 150-162 ID GS 100w PL Available
C73RXB1106B 100w CD DES Repeater
VHF 250 Watt Base Parts; Exciter Drivers
Power Amps, Tone shelves; L.V. Power Supplies
Cabinets; Meters Panels

Miscellaneous

MT & MX Convertacoms
UHF RF PA's 40 Watt
Expo Beliclips
HT440 Speaker Mikes
Comparators, Centracom;
Power supplies
136-150 162-174 406-420 Micors
Syntors Syntor X's
Test equipment and Motorola,
Cushman
P1001BX Code Inserters

For Sale Centra Com I Centra Com II

-Whole or in Parts-
Centra Com II
Reprogramming and
Custom Changes

Northeastern Communications Inc.

Waterbury, CT 06705

(203)575-9008

Circle (96) on Fast Fact Card

Townsend Electronics
"RIG SAVER"
ANNOUNCING
NEW
MOBILE MOUNTS



Mobile Radio Mount
10" tall for
radios up
to 15 #
FAX
1-219-594-5580
Ph. 1-219-839-5203
or write
Townsend Electronics, Inc.
P.O. Box 415
Piercetown, IN 46562
Visa/MC accepted

Commercial Mount
\$49.95
+ \$3.00
S & H

for heavier radios and for
more than one radio with
optional arms



**NOTHING STICKS
LIKE OUR LABELS**
(well almost nothing)

Call for FREE samples and
discover how quick and easy
it is to have your LOGO on
the products you sell or lease
Get our update on BAR-CODE and
BLAZER-CALS™ too.

ADVANCE LABEL & TAG
1725 N. McDONALD ST.

McKINNEY, TEXAS

1-800-466-5345 214-542-5345

Outstanding quality at competitive prices

FOR SALE

KUSTOM ELECTRONICS INC.
Mobile Data Base Station
Equipment

- 1 NC-80 Communications Controller
- 2 Intelli-Koders (1200 baud)
- 1 Remote Base Station Controller

A \$35,000 value; call with offer:

Rusty Schwarz

914-365-7623

Channel Elements

100,000 Freqs in Stock!

MASTR II, MVP, EXEC II

MICOR, MOCOM & MOTRAC

\$20 w/trade or \$25 w/o trade

Lifetime Warranty

3-Day Standard Delivery

1-800-237-9654

CHANNEL ELEMENT HQ.

4120 Kirby Road

Cincinnati, OH 45223

We Buy Channel Elements.

MOTOROLA CENTRACOM I & II

Console components

BOUGHT & SOLD

Telecommunications
Engineering Associates

409 Wildwood Dr.

So. San Fran., CA 94080

Ph: (415) 871-4200

Circle (97) on Fast Fact Card

Replacement Batteries

Centurion's full line of batteries to fit leading models perfectly.

For Two-Way Radios and Cordless Telephones

■ Motorola ■ GE ■ Uniden ■ Maxon ■ King

■ Midland ■ Cobra ■ AT&T ■ Radio Shack ■ Sanyo

For a distributor nearest you, please call

Toll Free 800-228-4563; or toll free fax 800-848-DUCK (3825)



P.O. Box 82846 ■ Lincoln, NE 68501

Circle (99) on Fast Fact Card

**WE BUY AND SELL USED MOTOROLA
AND GE FM TWO-WAY RADIOS**

- 1 MSF5000 RPTR., 900MHz, C65GF87206AT
- 215 GE CORONA, 800MHz, TRUNKED MOBILES
- 40 GE MARC V, 800MHz TRUNKED PORTABLES
- 1 MEMCOM BASE, 460MHz, Q1447
- 1 MSF5000 RPTR., 460MHz, C74CLB7106AT
- 2 MICOR RPTRS, 460MHz, C64RXB3106AT (DVP)
- 1 MICOR RPTR., 460MHz, C34RCB3105T
- 26 MICOR, 495MHz, T74RTA3000
- 30 MICOR, 460MHz, T74RTA3000
- 10 MOSTAR, 460MHz, D44TZA7D00
- 13 MAXAR 80, 460MHz, D34TSA6000
- 8 APCOR, 460MHz, P44ESN3191A
- 1 MICOR BASE, 163MHz, C73RTB1105
- 99 MICOR 173MHz, T83RTA1200
- 10 MAXAR 80, 173MHz, D43TSA3000
- 1 MICOR BASE, 165MHz, C53RXB3126AC (DVP)
- 30 MX350, 165MHz, 443AXU3120 (DVP)
- 4 SYNTOR X, 155MHz, T83VB7D04
- 25 MITREK, 153MHz, T83JJA3000
- 162 MICOR, 153MHz, T73RTN3100
- 53 MITREK, 48MHz, T81JJA2900
- 18 MOCOM 70, 48MHz, T71BBA1000

SCHAEFER RADIO CO.

1301 Grant • Box 395 • Denver, IA 50622

(319) 984-6115 or FAX (319) 984-6220

★ UHF REPEATERS ★ GE MASTR II

UHF, 100 & 65 watt, Cont. Duty,
Duplexers, Perfect Cond.
VHF also avail.

601-264-9760

GE 2-WAY RADIO WHOLESALE DISTRIBUTION CENTER

D&L CONNECTIONS

- Less than wholesale prices
- One million dollars of GE equipment
- Same day shipping • Express Repair power

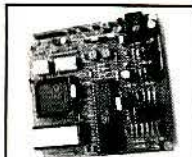
1-800-336-6825

A DIVISION OF...D&L COMMUNICATIONS, INC.
3512 CAVALIER DRIVE • FORT WAYNE, IN 46808

Circle (98) on Fast Fact Card

Equipment for sale

Natural Voice Playback



- Repeater Identifiers
- Site Alarms
- Remote Telemetry
- Weather Stations
- Multiple Languages
- Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies consisting of over 100 words or **multiple phrases** up to 1 minute in a *Natural Voice* is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

Parallel input word select	8 ohm Audio output
500 ma keyline output	600 ohm Audio output
32 Kb sampling rate	+9v to +14v supply
Multiple modes	Size: 4.00" x 4.25"
Selectable timing	Connectors included

Several different models available

Palomar Telecom, Inc.

300 Enterprise St., Suite E - Escondido, Ca. 92025
(619) 746-7998 • Fax (619) 746-1610

New Device Forwards Calls to SMRs

Your SMR users can now be reached by the people who need to find them - without the hassle of over dialing.

New **LOGOS** provides selective call forwarding from a land line to any phone number - anywhere. The caller simply calls the SMR user's office number as usual and LOGOS will forward all incoming calls to the SMR, or

forward only those callers who know the VIP touchtone code.

Compatible with SMRs, roaming cellular, private interconnects, paging and wireline systems, with or without over dial.

- Inexpensive. No monthly fee.
- Modular plug-in installation. All solid state.
- Requires only one phone line equipped with 3-way calling and DTMF signalling.

- User can reprogram **LOGOS** from any DTMF phone anywhere following simple voice prompts.

Call now for details:
1-800-442-4887

Made in U.S.A.



Logotronics Communications LLC, 12421 Washington St., Thornton, CO 80241

Dealer Inquiries Invited.

Circle (100) on Fast Fact Card

CRYSTALS FOR ALL RADIOS

Communication Crystals

All makes and models

Channel Elements

Recrystallized and compensated

COMPETITIVE PRICING!

Emergency Service

For Crystals: 24 Hours - 72 Hours - 1 Week
Normal Delivery: 3 Weeks

800-333-9825

CAL CRYSTAL LAB, INC.

1142 N. 4th Street, Anaheim, CA 92801 • FAX 714 431-9825

Glenayre 1205 Terminal
100% Operational
5 RF ch. - 2 & 5 Tone Paging
DTMF Decoders - G Marc overlay
4 Dids
Some Spare Boards
Triangle Communications Inc.
Bob Landis
717-656-2211

BUY - SELL RADIOS

NEW & USED
Johnson - Motorola
Standard - Uniden
Buy-Comm-Co.

Steven Kenney
1-800-347-4121

(602) 870-4121

FAX (602) 395-1357

2340 W. Columbine
Phoenix, Arizona 85029

40 YEARS OF QUALITY



INTERNATIONAL
CRYSTAL
MANUFACTURING
CO., INC.

PAGER, PORTABLE REPAIR

PHONE: 800-426-9825 FAX: 800-322-9426
729 W. SHERIDAN • OKLAHOMA CITY 73102

FOR SALE

***IFR** 1200s with Cellular Option .. \$7,500.00
*Two—Motorola Pulsar II VHF/IMTS/Bell
Phones \$300.00 ea.

Call Greg with best offer
Day-Answering Service (713) 649-5537
Evening—Home (713) 649-1503

MOTOROLA Radius DELIVERY NOW!

Every Model in Stock! Free Programming of all new units on Delivery!
Will Positively Be Shipped Tonight!

On your jobsite tomorrow. We can handle any size order and have done so for 18 years.

CALL 1-800-53-RADIO (72346)
FAX (404) 568-4506

To place your order, even if you live in Hawaii, Virgin Islands, Alaska or Puerto Rico. **RADIO WHOLESALE - John Cunningham WB4-JUN.**
One of the largest stocks of Motorola Radius in the world.

Circle (101) on Fast Fact Card

Dual Control Head Adapter for EFJ Challenger Mobiles

Mark Bitting Inc.
P.O. Box 13; New Cumberland, PA 17070
(717) 774-7203

BUY — SELL

LB-VHF-UHF-800-900

Trunked-Conventional

Call for Prices and Availability

718-262-9727

Mobile Extender DGME 1000
Digital Gated Repeater Maker DGRM 501
The DGRM 501 provides for repeater operation while the DGME 1000 provides for mobile extended operation with use of most any two transceivers. Repeater, Extend, Cross Band & Link, Least Line operation. Digital gate circuit for positive control and min. power draw. DGRM 501 & 501B ideal for remote locations.

DGRM 501 \$89.00	DGRM 501B & DGME 1000 \$169.00
---------------------	-----------------------------------

Made in the USA

Order 1-800-283-5158 1 year limited warranty

NEW! Programmable Delay Timer DG 200 Series
This unit provides control of radio with delayed shut down after ignition is turned off. The DG 200 Series is a dip switch programmable timer with delayed time settings of 15 min to 12+ hrs. This unit will handle 30 continuous amps at 12V. The DG Series timer eliminates battery failure due to leaving mobile, computer, AVL, MDT, Trunking or other equipment inadvertently.

COMM-NET 2000
COMMUNICATIONS/MANUFACTURING
P.O. Box 20 5407 N.E. Stephens
Winchester, OR 97495 Fax (503) 672-6475



DG 200 Series \$38.00

Equipment for sale

MIDLAND LMR

LAND MOBILE RADIO Nationwide

**Factory Approved
WHOLESALE PRICES**

- Large Inventory • Fast Service • Flat Rate Repair Service
- Complete Dealer Support Program

Dealers Only

(800) 726-9015
(612) 869-2487

SAME DAY SHIPPING

Call for Weekly Specials!

Refurbished Equipment Available

FAX (612) 869-3078

RCW

DISTRIBUTING

816 W. 77½ Street
MPLS, MN 55423

Circle (102) on Fast Fact Card

USED PAGERS

Motorola and NEC. Reconditioned on your channel w/warranty, or "as is".

ACS (303) 337-4811
FAX (303) 337-3084

GE EXEC II

VHF 60 watt Mobiles
w/o acc. \$79 w/acc. \$99

VersaTel

1-800-456-5548 Fax: 307-266-3010

• MOBILES • BASES • PORTABLES • PAGERS • REMOTES •

PCI — PEKAAR COMMUNICATION INC.

Steve's back, formerly of Gregory Electronics Corp.

\$ Specials of the month. \$

GE Phoenix Mobile N3A01 HB Crystal Type	Special...\$98
GE Classic Mobiles 800 MHz range, front mount or rear mount	Special...\$98
GE Delta Mobile 40W, M3HH Crystal Type HB less acc	Special...\$65
GE Mastr II Mobile MC74 100W. 36-42 range w/acc	\$198
Mot Mocom 70 U44BBN3000 w/acc	\$98
GE Siren Amps 4EA22B10	\$45
Mot Moxxy D51GMA4000AK 60W. LB on 37MHz. w/acc	\$135
GE Portamobile II 36-42 range. 132-150 range	\$68
GE MPX Portables P4BWW55EEN, TX 806-825, RX 851-870	\$135
GE MPX Portables P2BRR56AKM	\$98
GE MPX or MPX Rack Chargers	\$65
GE DC Control Cards 19D416661G6	\$25
GE C800 Control Heads	\$15
Mot Micor 470-490 range, T44RTA less acc	\$60

Catalog Available

If you can't find it, try us!

Call (201) 772-0704

• BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS •

Circle (103) on Fast Fact Card

COOK'S COMMUNICATIONS

GE

LTR

160 N. Broadway
Fresno, CA 93701



VISA
MASTERCARD

MOBILE AND PORTABLE RADIOS AT
WHOLESALE PRICES

1-800-233-8818

MAY BRINGS QUALITY PRODUCTS AT WOLFE COMMUNICATIONS

BASES/REPEATERS

Micor 36-42mhz. 110W int. duty	\$1200
Micor 42-50mhz. 110W int. duty dual rx	\$1500
Micor 150-160mhz. 110W int. duty dual rx	\$1700
Micor 150-160mhz. 60W local cont.	\$650
Micor UHF. 75W cont. duty, single user	\$1900
Standard UHF. 75W cont. duty, Wduplex	\$2500
Master II UHF. 100W cont. duty, tone control, duplex	\$3000

MOBILES

Moxxy D31 30-36mhz. all acc. AS 15	\$95
Maxar D31 42-50 mhz. ext. all acc	\$135
Mitrek T51 30-36 mhz. all acc	\$350
Mitrek T51 36-42 mhz. all acc	\$350
Master II 42-50mhz. N.B. DUO	\$160
Micor T73 150-160mhz. DUO	\$300
Midland 70-535 UHF all acc. prog	\$350
Midland 70-565 UHF all acc. prog	\$350
Uniden FTU-500K, UHF, all acc	\$250
Mostars D44T, A7900BK UHF, all acc	\$200

Micor T54 UHF DUO

Micor T34RTA3803BASP11, all acc. AS 15 \$150

ACCESSORIES

Mitrek acc. group checked	\$125
Master II acc. group SPECIAL	\$75
Micor acc. group SPECIAL	\$75
Master Exoc II acc. group SPECIAL	\$65

PORTABLES

MT-500 42-50mhz. w/chargers	\$200
MT-500 VHF 4 freq. P.L.	\$100
Standard HX 300 135-144mhz. w/charger	\$95

MISCELLANEOUS

2: TPL PA1 1AE 35-50mhz. power amps 100W	\$125
RF GAIN RFA5100U UHF power amp 100W	\$150
Motorola T-1600 remotes	\$300
Decibel DB-408, 6.6 gain ant. UHF	\$200
11.5dBd gain 10 element UHF Yagi	\$75
Decibel DB-5012 side mount kit	\$100

CALL FOR CURRENT FLYER

All sales cash or cashiers check. Fax: (406) 252-9617
1113 Central Ave. • Billings, MT 59102 406-252-9220

RAMSEY COM-3

The communications service monitor that's missing one feature . . . HIGH PRICE!

- Frequency coverage 100 KHz to 999.999 MHz
- Signal Generator 0.1 uV to 10,000 uV with reverse power protection . . . no more front-end blowouts!
- Built-in 1 GHz and audio frequency counter
- Modulation includes 1 KHz, CTCSS or external
- The most popular low cost high performance monitor. . . thousands sold worldwide
- Extremely portable, only 13 pounds includes rechargeable battery at no extra cost
- Call for free 10 day trial in your shop



Ramsey Electronics Inc.

793 Canning Pkwy

Victor, NY 14564

716-924-4560

716-924-4555 (FAX)

\$2795.00

Circle (104) on Fast Fact Card

USED RADIOS at Low Prices!

- MICOR
- MITREK
- PORTABLES
- MOCOM 70
- MAXAR
- RPTRS
- GE
- RCA
- ACCESSORIES
- TONE ELEMENTS
- CRYSTAL ELEM.
- BASE STATIONS

Large Quantities • (817) 433-5452

STOP

MOTOROLA RADIOS

End users shop first then call for best price.

Procomm

805-497-2397

Equipment for sale

GE DESKON II DC Remote

1 channel \$49 2 channel \$59

VersaTel

1-800-456-5548 Fax: 307-266-3010

RADIUS

WE'LL BEAT YOUR BEST PRICE!

California Radio 800-231-0103

LAND MOBILE RADIO BBS

Buy - Sell - Trade used radio equipment with hundreds of other dealers nationwide. Call with your modem to register now.

The CommLine BBS
313-854-6441

REMOTE MONITORING SYSTEM SENDS ALERT MESSAGE TO PAGER

PAGNOW! automatically alerts a pager indicating a problem and its location. Also monitors power. Internal rechargeable battery provides backup operation for 6-12 hours. Two inputs plus one output.

New Product for
Alpha Pagers, Too!

USE FOR

- Building Security • Equipment Failure
- Power Out • Smoke/Water Level
- Tower Lighting • More!

Call Toll-Free Now To Order
or Request More Information

1-800-722-2353

OUTPUT MODULE

For On/Off control of lights or equipment
up to 1 kW

COMPUQUEST, INC.
801 Morse Avenue
Schaumburg, IL 60193

Circle (105) on Fast Fact Card

ALTERNATOR NOISE? GET THE STC 40-A HIGH POWER FILTER.

SPECIFICATIONS

Voltage: 13.8 V Nominal, 20.0 V Maximum
Current: 40.0 Amps Continuous, 60.0 Amps Intermittent,
100.0 Amps Surge
Voltage Drop Ratings: 0.5 Volts @ 20 Amps, 0.8 Volts
@ 40 Amps, 1.3 Volts @ 55 Amps

Advanced Electronic Filter Inc.

To Order: (716) 656-1105 Fax: (716) 656-9141

Noise Rejection: Better than 98% of Alternator induced Noise
Dimensions: 6.5L x 3.25W x 2.5H

FEATURES:

- Heavy Duty Anodized Aluminum Housing
- Black-Negative Ground Red-Positive Ground
- 10 Gauge Stranded Wire with Crimps For Easy in-Line Installation
- Not a Kit, Completely Assembled
- 3 Year Warranty Against Defective Parts & Craftsmanship

\$79.95

Cellular services

PHILA., PA., SO. JERSEY
\$250⁰⁰ Commission
METROPHONE

Professional on-site installation ... \$125
Warranty service on all brands.

**ADVANCED CELLULAR
OF PHILADELPHIA**
800-233-0013 • IN PA 215-322-4600

Rentals

MOTOROLA RADIO RENTALS

- MT1000, HT600, P200
- Intrinsically Safe
- All Types Headphones
- Mobiles & Portapacks
- Repeaters & Crossband Sets
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.

SCA
Shima Communications of America Inc.

PAGERS

**NEW
FROM CA!**

CA

(800) 435-9313

In Illinois (800) 892-1611
Order Fax (800) 284-4934

MODELS:

- Pen Pager • DVT
- Checkmate III • MOE
- Monipage • AL

distributed by

**Communications
Associates Inc.**

Circle (106) on Fast Fact Card

AF

Antenna Farm
11500 W. 90th St. • Overland Park, Kansas 66214
913-492-6212 FAX 913-492-2948

BIRD

Wattmeters, elements, loads and accessories
in stock and available for immediate
delivery.



LOW PRICES • 1-800-255-6222 • FAST DELIVERY

Circle (107) on Fast Fact Card

Equipment for sale



**GENERAL
COMMUNICATIONS**

MIDLAND LMR
LAND MOBILE RADIO

**WHOLESALE PRICES ON ALL
MIDLAND RADIOS!**

CALL TODAY!



1-800-356-3200

5157 Anton Dr.
Madison, WI
53719

Tower space

**COMMUNICATIONS
SITE SPECIALISTS.**

- ✓ Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing
- ✓ Sites Available Now ... IL, IN, MA, MD, MI, MO, NC, OH, TX, & VA



FACILITIES MANAGEMENT, INC.

10 Woodbridge Center Drive, Woodbridge, NJ 07095
(908) 636-6970 • FAX (908) 636-7260 • Toll-Free: (800) 247-4796

© 1991 RAM Facilities Management, Inc.

Circle (108) on Fast Fact Card

Rentals

MOTOROLA
RENTALS

- NEW!! GP 300
- P200, HT600
- Mobiles, Repeaters
- Dealer discounts
- Commissions paid

1-800-767-1963

MOSS
COMMUNICATIONS

Tower space

John M. Rowe
Antenna Sites' Services
Site Acquisition, Leasing & Zoning
Specialist
R
REALTOR®
1236 Corona #2
Denver, CO 80218
(303) 830-0815

TOWER SPACE
Microwave Tower Route
Minneapolis, MN to Omaha, NE - 12 sites
**QUAD STATE TOWERS AND
COMMUNICATIONS**
507-283-8042

Tower space

**We've got you
covered.**

For superior antenna site coverage along with the Quality and Customer Service you expect from an industry leader - choose Motorola. Our nationwide network of antenna sites offers you space on thousands of premier antenna sites across the country. Contact Motorola Network Services Division today for your local and national site needs or to find out more about our site planning and management services.

U.S. Network Services Division,
Antenna Site Information
708-576-5484



Circle (110) on Fast Fact Card

**TOWER SPACE
NEW ENGLAND AREA**

Foxboro, MA: Lat. 42-05-43, Lon. 71-13-52
AGL 465' AMSL 865'

Kingston, MA: Lat. 41-57-45, Lon. 71-43-01
AGL 468' AMSL 728'

Medford, MA: Lat. 42-25-51, Lon. 71-05-22
AGL 350' AMSL 538'

JOHNSTON, RI: Lat. 41-48-12, Lon. 71-33-27
AGL 490' AMSL 990'

Hopkinton, RI: Lat. 41-29-41, Lon. 71-47-05
AGL 564' AMSL 949'

Farmington, NH: Lat. 43-21-16, Lon. 71-04-19
AGL 592' AMSL 1600'

BOSTON, MA TALL TOWER—NEW
Quincy, MA: Lat. 42-14-47, Lon. 71-02-55
AGL 700' AMSL 880'

SOUTH FLORIDA TALL TOWER—NEW
Miami, FL: Lat. 25-58-15, Lon. 80-12-32
AGL 1044' AMSL 1049'

**Industrial Communications &
Electronics, Inc.**
100 Marion Drive
Kingston, MA 02364
CONTACT: DAVE FENTON
1-800-323-7212 Outside Mass.
617-585-9100

Circle (109) on Fast Fact Card

**TALL TOWER: WASHINGTON, DC
SOUTHERN MARYLAND**

30°37'07" x 76°50'42" North of Waldorf & 10 miles south of Andrews AFB. 768' AGL 949' AMSL. Receive antennas on top. No interference *guaranteed!* VHF and UHF Combiners. 800/900 MHz ports available. Tower has plenty of room for large dishes. 24 Hour access. Emergency power included. Closed air conditioning, very clean.

Call Chip Fetrow 301-899-3014.

TOWER SPACE

Victorville at 4482 and Barstow, CA at 3325 feet.
**MICROWAVE CIRCUITS BETWEEN
SITES.**

CALL NOW: (818) 308-0398
FAX: (818) 308-3909

Tower space

TOWER TECHNOLOGY CORPORATION

We have the finest, professionally managed antenna sites in Florida. Master Antenna System for UHF & 800 MHz using 3/8" hard line. Four window tower top amp. If you need antenna space in:

Jacksonville • Tampa Bay • Sarasota/Venice
Lakeland • Disneyworld/Kissimmee/St. Cloud

Contact: **Bruce McIntyre**

(813) 854-1518, 105 H Dunbar Ave.
Oldsmar, FL 34677; FAX: (813) 855-1969

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi

ANTENNA SITES, INC.
602-451-7702

TOWER SPACE

Westchester • Putnam, NY
Newly installed low-loss combiner systems for 150-900 MHz. Bogner antenna—900MHz. Antel antenna—450MHz. Elev. over 1,000 ft. Easy access all year. Covers Northern Westchester, Putnam, Rockland and Connecticut.

SIGNAL TOWER COMPANY, INC.
(914) 633-0569

PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AMSL 2635' AAT, Overlooking Reno and Fallon and the I-80 corridor,

CALL NOW, **702-827-6060**
HIGH COUNTRY COMMUNICATIONS

Services

FCC License Preparation

Fast, Easy, Home Study, Inexpensive.
Top Jobs — Top Pay \$\$\$
Audio & Video Courses Available.

FREE Details
WPT PUBLICATIONS
1-800-800-7588



JEFA
INTERNATIONAL, INC.

E F & I Turnkey
Microwave & Two-Way Services

Engineering
System Design
Equipment
System Installation

1116 Dobie Drive 214-424-5680
Plano, Tx 75074 214-423-5862 FAX

ONE OF THE WORLD'S FINEST COMMUNICATIONS SITES!

It wouldn't be prudent to overlook the only site in downtown Boston that has been engineered to this magnitude. This site **CAN HEAR**, has **NO INTERMOD** and **GUARANTEES IT IN YOUR LEASE AGREEMENT** and **IT'S NOT EXPENSIVE**.

Downtown Boston's tallest building has prewired electrical and Telco, emergency power, system grounding, air conditioning, 24 hr. card access, good lighting, fiber, and antennas, transmission lines combiners and receiver multicouplers available for all bands. A protected receive level at 700' AMSL and more.

CALL NOW FOR RATES AND INFO. ON OUR OTHER SITES

Lat 42° 21' 08" Long 71° 03' 25"

Skyline Antenna Management, Inc.

Call Peter Kovaleski, 203-684-4444

Circle (111) on Fast Fact Card

37 CALIFORNIA ANTENNA SITES

- Major Locations • Stand-by power
- Secure facilities • Air Conditioning

Or develop your own site.
Land available at
Oat Mountain/Chatsworth.

**MERIDIAN
COMMUNICATIONS**

Since 1956

23501 Park Sorrento, Ste. 213A

Calabasas, CA 91302-1355

Contact Rich or Jack Reichler at

818/888-7000

Services



DUPLETUNE

303 Fries Rd.

TONAWANDA, NY 14150

716-834-2787

REPAIR & RETUNING

OF

DUPLEXERS

Filter Systems

Rx Multicouplers

NEED TENANTS??

Advertise your sites in the

**NATIONAL COMMUNICATIONS
SITE DIRECTORY**

Dedicated to advertising antenna sites for lease

NEED SITES?

The NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRAFAAM, Dept. M, P.O. Box 6093
Freehold, NJ 07728 (908) 462-5964



TEL: (708) 823-7713

**CHICAGO TOWER
LEASING CORP.**

**COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA**

P.O. Box 31150
CHICAGO, IL 60631

Services

!!! FCC FREQUENCY INFORMATION !!!

Parts 90, 95 and 22

Custom Reports: Marketing or Engineering—Your Geographic Area
Database Updated Daily

- Private Land Mobile Radio Services
- Common Carrier and Private Carrier Paging
- Cellular Licensees with Cell Sites
- SMRs—Trunked and Conventional
- VHF and UHF Control Links

Output on diskette or 9 track tape (printouts also available) for easy analysis of your data:

- Sort by your priority
- Identify potential customers
- Identify potential interference
- Locate transmitters
- Only the information fields you want
- Print mailing labels
- Identify used and unused frequencies

Call or Fax your request for a **FREE ESTIMATE**



COMSEARCH

An Alliance Telecommunications Company

Business Information Services—251 West Renner Road, Richardson, TX 75080

Phone: 214/680-1000

Fax: 214/680-9802

Circle (112) on Fast Fact Card

Services



SERVICE MONITOR REPAIR CALIBRATION AUBURN ELECTRONIC LABS

12345 Bowling Green Road, P.O. Box 447, Auburn, KY 42206
WE ALSO BUY AND SELL

ALL TYPES

502-542-6000, FAX 502-542-7706
1-800-542-6010

HT600/P200 2 ch to 6 channel
CONVERSION \$40.00
Out of Band Modifications for
Radius Portables and Mobiles
Metrocom 718-392-3300

Computer software

Computer Resources Inc.

The Service Management system is designed for the management of a mobile communications company. It provides the user with work orders, and work order history, inventory control and purchasing, contract management and costing, equipment management and costing, and technician productivity. Also available are Recurring Billing, SMR Billing, Pager Billing and Inventory, plus Accounts Receivable, Accounts Payable, General Ledger, and Payroll.

205/591-8810

Circle (113) on Fast Fact Card

**Use
Mobile Radio
Technology
Classified Ads**

FCC

REAL TIME ACCESS •
DISKETTES •
9 - TRACK TAPES •
CUSTOM REPORTS •
LABELS •
PROSPECT LISTS •
RADIUS/DISTANCE SEARCHES •
REGIONAL UPDATE SERVICE •

**THE MOST CURRENT FCC DATA
AVAILABLE TO THE PUBLIC**

- Part 90 } *Granted and Pending*
- Part 95 }
- Part 22 }
- Part 68 *Telephone Interconnect*
- FCC *Administrative System*
- MDS *Microwave Data*

**ATA Services
(703) 838-1900**

Computer software

DUPLER TUNING



Minimize your Losses
Maximize your Gains

D P ELECTRONICS, INC.
152 Floyd Avenue
Bloomfield, NJ 07003
(201) 748-6334

*Making The Connection
In Communications*

Computer software

★ **COMPLETE PAGER** ★
★ **BILLING SYSTEM** ★

Air Time Billing, Customer Files, Full Inventory, Accounts Receivable, Many Reports, Reports By Carrier, Add on Modules, Add as You Grow!!
Plain Paper Bills or Custom Forms.

★ **FREE DEMO DISK & MANUAL** ★
ALWAYS ONCALL - 516-233-6000

SMR BILLING / ACCOUNTS RECEIVABLE \$396

*CES *IDA *Johnson *Trident *Uniden *Zetron

Billing	Accounts Receivable
Recurring Billings (<i>flat rate</i>)	Apply Payments
Daily Billings	Generate Statements
Air Time Billing	Print AR Ageings
Long Distance Billing	Generate Service Charges

- Handles all of your business billings.
- Easy to understand and learn.
- Requires a minimum of file data keying.
- Mix or match different download formats.
- Simple and flexible approach to sales taxes.
- General Ledger Interface.

CLEVER SOFTWARE

3033 13th Ave. SW, Suite 139, Fargo, ND 58103
Phone: 701-237-0277 Fax: 701-237-0228

RADIO SYSTEM DESIGN

Computer Software for PC's

- * Digital Topography - 3" and 30"
- * 3-D Displays
- * Geographic Boundaries
- * Radio Coverage
- * Demographic Analysis
- * Path Profiles
- * Full Range of Design Options

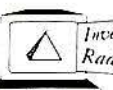
Applied Spectrum Research

2975 Valmont #100
303 444 4871

Boulder, CO 80301 USA
FAX: 303 444 4872

Pyramid Communications Service Management Software

Version 3.0
50+ Functions
\$179 Complete



Inventory Serial #s
Shop Eq Par
Radios Shop History

Free Demo
& Manual

Mailing labels Invoices
Kits Forms Productivity Reports
Customer Data Repairs

210 Main St #153 Seal Beach CA 90740 (310) 430-5892

YOUR AD COULD BE HERE!

for just \$69!

Call or fax:

**Mobile Radio
Technology**

Carla Gamino
303-762-1249

FAX: 303-762-0069

Computer software

SCADA Software

TURBEX-Z for water quality, waste water and general site monitoring and control using **ZETRON** equipment via packet radio.

AgZax for agricultural monitor and control using packet radio.

CYCURE turnkey site security monitoring system, auto alpha paging, billing and invoice system, uses **ZETRON** Mod 17 and 2000 series.

TECHNICAL AND ENGINEERING

TDEX2 path, propagation, terrain analysis, contours, area, shadowing workstation interface.

IMSITE V 3.10c intermod and general interference analy. includes small expert system, worlds fastest, hands down, no excuses.

OMEGA5 PE's Intermod prm. includes **IMSITE**.

SERVICE SHOP AND BILLING

CYRNET service shop oper. system, recurrent billing, terminal equipt. download, interface and conversion, autopricing from mfg. data or inventory, FIFO or LIFO, service history tracking, numerous reports, good management, tech utils, highly configurable system for PC networks.

CYR-XCHANG turnkey answering service with AR and billing for PC networks.

**Updates Available —
Please Call**

**Full BBS Support
CyberSym Control Systems
P.O. Box 227
Blacksburg VA 24063
703-268-5400 Voice
703-268-9767 BBS**

Circle (114) on Fast Fact Card

Computer Software for Communications Engineering Applications

VHF/UHF Land Mobile Radio Engineering Programs

- Predicted Area Coverage, Shadow, & Field Strength Models
- FCC Carey Curve Contour Plotting and Reports
- Point to Point Link Analysis and Path Profiles

Microwave Engineering Programs

- Path Analysis and Profiles
- Quadmap Crossover Points
- 3 and 30 Second Digitized Terrain Elevation Data
- CD-ROM and Floppy Diskette



ROCKY MOUNTAIN COMMUNICATIONS, INC.

2023 Montane Drive East ■ Golden, CO 80401-9124
(303) 526-5454 Fax: (303) 526-2662

CALL TODAY FOR YOUR FREE DEMO DISK!

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo-Graph Profiles
- HAAT Calculations

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS

(CEMS)

LAND MOBILE RADIO COVERAGE

(LMRC)

3 Second
Terrain Data

MICROWAVE

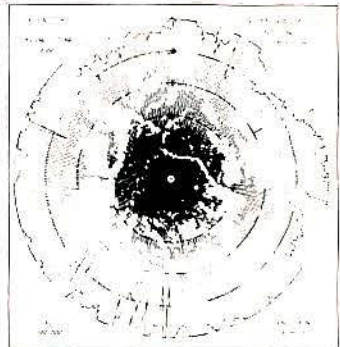
- Menu Driven - Color Coded
- On-Screen Path Profile Design
- Diffraction Loss Calculations
- Reflected Signal Analysis
- Route and System Diagrams
- Map Crossings - Graphic with Dimensions
- Performance Predictions: Analog, Digital and Video

LAND MOBILE RADIO

- Coverage Diagrams
- Multiple Prediction Models
- 360 Radials - 50 Mi (80 Km) Radius
- Relief Maps in Color
- Intermodulation Calculations
- 300 Tx and Rx Frequencies
- Up to 99th Order
- Graphic Presentations

NORTON ENGINEERING
10002 McDuff Court
Vienna, VA 22181
703/938-5745
Fax: (703) 938-9168

Demo Disk
and
Sample Printouts
Available



Circle (115) on Fast Fact Card

GET THE EDGE OVER YOUR COMPETITOR

ADVERTISE IN
**MOBILE RADIO TECHNOLOGY
CLASSIFIEDS**

Call Carla Gamino at 303-762-1249 Fax 303-762-0069

Computer software

CDS is pleased to announce the latest addition to our list of RF Engineering Tools™...

Real World Propagation™

WORKSTATION

Now you can put our Real World Propagation™ Study program on your desktop. Incorporating U.S.G.S. 3 Arc Second Terrain Data and U.S.G.S. Land Use and Land Cover Data, this program is based on the "Longley-Rice" radiowave propagation model, corrected for the effects of surface (building) clutter and vegetation cover. Extensive field measurements were used to develop and verify the model and reveal it to be the most accurate available. Other widely-used prediction programs used have been included in the Real World Propagation™ WORKSTATION package.

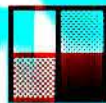
Other CDS RF Engineering Tools™:

- Real World Propagation™ Studies • 3 Arc Second Terrain Data on CD-ROM
- Land Use and Land Cover Data on CD-ROM • 1990 Population Data on CD-ROM
- Online/Remote Access Services • FCC & FAA Databases for PC

Richard P. and Richard L. Biby, Principals

Communications Data Services, Inc.

6105-E Arlington Blvd., Falls Church, VA 22044
(800) 441-0034 Fax (703) 534-7884 root@comm-data.com



Circle (116) on Fast Fact Card

Repair services

**We're Moving Ahead
to expand facilities.**

1445 MacArthur Drive Suite 240
Carrollton, TX 75007

ELECTRONIC PAGING SERVICE PAGER REPAIR

Repair • Recrystal • Recode

- Flat Rate: \$10 plus parts
- Quick turnaround
- Computerized pager tracking system
- Full bar-coding capabilities
- Contract rates negotiable

**Same Phone #
(214) 242-1887**



Terrain Analysis Package (TAP)™ PC-based software for RF studies

- Area field strength coverage maps.
- Shadow maps.
- Choice of propagation models.
- Point-to-point/microwave fade margin and reliability calculations.
- User-customized data base for buildings and vegetation.
- Digital elevation data on floppy disk or CD-ROM.
- Intermodulation product studies.

Free demo disk upon request.

SoftWright
Limited Liability Co.

791 South Holly Street
Denver, Colorado 80222
(303) 329-6388
FAX (303) 329-0901

Believe it!

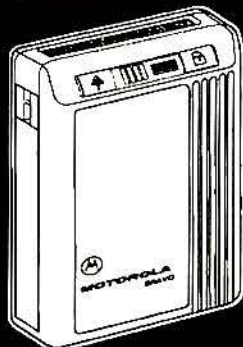
ONE WEEK TURNAROUND

NEC • MOTOROLA REPAIR
AND PANASONIC
BRAVO LCD • DISCOUNT FOR REFREQS



National Pager Services, Inc.
131 Chesterfield Ind. Blvd.
St. Louis, MO 63005
314-532-4226

Repair services



PAGER REPAIR • N A T I O N W I D E •

- Guaranteed Fast-Turnaround
- Flat Rate Labor (plus parts)
- Service Contracts for New & Existing pagers
- Volume Discounts Available
- Refurbished Pager Sales

KERN

PAGER REPAIR

1-800-844-KERN

834 Foley Street Jackson, Mississippi 39202

Circle (117) on Fast Fact Card

\$25.00 FLAT RATE
Plus Parts & Shipping
On the following models:
XLH-250 RH-250
RN-256 WH-2516
WH-2510 REH-252
UC-102 UC-202
TRH-202



*OTHER MODELS—\$25/HR Plus P[arts] & Shipping
≡ **MULTICOM** ≡
2412 N. Moore Ave. • FAST TURNAROUND
Moore, OK 73160-3316 • FACTORY TRAINED
405-799-7356 800-880-7356 • VISA - MASTERCARD - COD

**When Your Pager Problem Stack Up
Turn to Page Repair**

- \$10 Flat Rate Labor • Recrystal & Recode
- 30 Day Warranty • Repair Contracts
- Warranty Contractors

824 River Rd.
Edgewater, NJ 07020
(201) 943-9521



2700 Flora St.
Dallas, TX 75201
(214) 823-5177
PageRepair Inc.

PAGER/PORTABLE REPAIR

*Low-cost conversion
Discounts for quantity*

- Pager Repair:
- Flat rate—\$10 plus parts.
 - Monthly rates
 - Quick turnaround on most Motorola, NEC, Panasonic and others including LCD's.

Portable Repair: Flat rate—\$30/hr. plus parts.

Maximum 2 hours

**Call Pager Communications
for quotes: 1-800-955-1044**

Repair services

ACS

"The Pager Repair People"

High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola, NEC, Panasonic and Shinwa.

(303) 337-4811

PORTABLE REPAIR MOTOROLA

any

HT-200 to RADIUS

\$50 + PARTS

TBC AVIONICS, INC. (505) 821-7796

TWO-WAY REPAIR \$30/hr*

A.S.K. COMMUNICATIONS
1-800-827-0747

3837 E. Wier Ave., Suite #1
Phoenix, AZ 85040

*Plus parts & shipping

QUALITY REPAIRS

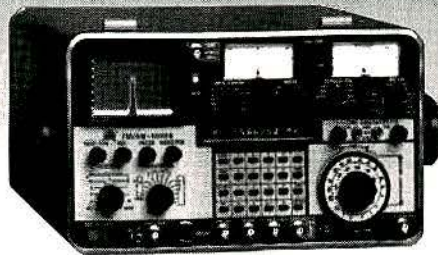
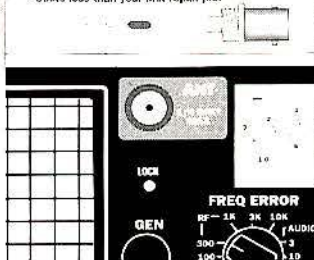
- MOTOROLA
- STANDARD
- UNIDEN
- JOHNSON
- MIDLAND
- AND MANY MORE!
- MOBILES & PORTABLES,
800 CONVENTIONAL

SERVICE MONITOR REPAIR/CALIBRATION

Repair/Calibration/Buy/Sell/Trade

RF Fuse Protection for IFR Monitors

- For models 500A, 1200A S, 1500, A1500
- Just \$50 inc. freight and 2 spare fuses
- Costs less than your first repair job!



Specializing in Service Monitors since 1973



**COMMUNICATION
INSTRUMENTS**

Phone (800) 288-8223
or (213) 322-3666

356 Hillcrest Street
El Segundo, CA 90245

Circle (118) on Fast Fact Card

CUSHMAN SERVICE CENTERS

THESE ARE THE ONLY FACTORY AUTHORIZED CUSHMAN SERVICE CENTERS

CUSHMAN/KNS ELECTRONICS INC.
(408) 432-8100
FAX (408) 432-8359

NS ELECTRONICS SERVICE, INC.
(404) 451-3264
FAX (404) 458-8785

CALL

(408) 432-8100 FOR FIXED
PRICE REPAIRS

All Service Centers for New Model
Demos and Literature

Circle (119) on Fast Fact Card

Equipment wanted



**WANTED 35 MHz PAGERS
WANTED 35 MHz
MOTOROLA**

Transmitters, PURC/Compa
Also, 900 MHz Repeaters
1-800-638-9969
Ask for Ext. #18

WANTED

UHF Mastr II's
UHF Mastr Exec II's
Small or Large Quantities
Call 817-433-5452

WANTED

MOTOROLA VHF (150 MHz) and UHF (460
MHz) Handhelds and Mobiles. Other types?
Service Monitors and Test Equipment.

The Radio Shop
"Don"- Arvada, CO
303-425-5786

Equipment Wanted

Motorola, Johnson, GE,
EFJ, Uniden, Standard

Buy-Comm-Co.
1-800-347-4121

FAX (602) 395-1357

Equipment wanted

PAGERS WANTED

Motorola, NEC, Panasonic

- Most Models • Any Quantity

McManus Communications

501/763-6250 Fax 501/763-6533

Use Mobile Radio Technology Classified Ads

Sales offices

PUBLISHER

Mercy Contreras
First National Bank Building
333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

SOUTHERN REGION

Diane Hite, Marketing Manager
First National Bank Building
333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

NORTHEAST REGION

Ruth Breashears, Marketing Manager
First National Bank Building
333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

WESTERN REGION

Dennis Hegg, Marketing Manager
950 N. Gate Drive, Suite 207
San Rafael, CA 94903
Telephone: 415-491-1442
Telefax: 415-491-1842

MIDWEST REGION

Nancy Matthews
55 East Jackson Blvd., Suite 1100W
Chicago, IL 60604
Telephone: 312-435-2340
Telefax: 312-922-1408

CLASSIFIED SALES

Carla Gamino, Classified
Marketing Manager
First National Bank Building
333 W. Hampden, Suite 803
Englewood, CO 80110
303-762-1249 Fax: 303-762-0069

EUROPE:

Nicholas McGeachin
Roseleigh House
New Street, Deddington
Oxford, OX5 4SP England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex 837469 BES G

JAPAN:

Mashy Yoshikawa
Orient Echo, Inc.
1101 Grand Maison
Shinjuku-ku, Tokyo 162 Japan
Telephone: 03-235-5852
Telex: J-33376 MYORIENT



Ad index/hotline

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
Advanced Receiver Research	44	39	203-582-9409	Maxrad, Inc.	25	23	708-595-3933
The Antenna Farm	81	107	800-255-6222	McManus Communications	75	86	501-763-6250
The Antenna Specialists Co.	IFC	1	216-349-8400	Mechem Electronics	78	96	703-373-3888
Astron Corp.	33	29	714-458-7277	Meridian Comms/Diablo Comms	31	28	818-888-7000
Automation & Electronics Engr.	76	90	800-527-4596	Midian Electronics Inc.	41	37	602-884-7981
Avtec Inc.	38	34	803-892-2181	Midland International LMR	18	17	800-MID-LAND
Barnett Engineering	68	67	800-268-2646	Mobile Mark, Inc.	22	20	800-648-2800
BEE Electronics Inc.	58	52	708-345-0337	Motorola C&E	82	110	708-576-5484
Bomar	8,77	8,95	800-526-3935	Multiplier Industries Corp.	14	13	914-241-9510
California Radio	75		800-231-0103	MX-COM Inc.	9	9	919-744-5050
Celwave	13	12	800-321-4700	New Mar	72	77	714-751-0488
Centurion International Inc.	78	99	800-228-4563	Norton Engineering	85	115	703-938-5745
Chargeguard Corp.	77	93	800-458-3410	Orbacom Systems Inc.	19	18	609-829-4455
Cimarron Technologies	17	14	800-487-7184	Paging Products Int'l.	76	89	713-991-4930
David Clark Company Inc.	16	15	508-756-6216	Peacocks Radio & Wilds Computer	77	91	800-232-7715
Coded Communications	10	10	800-228-6367	Pekaar Communications Inc.	80	103	201-772-0704
Combined Technologies Inc.	72	76	513-595-5900	Radio Express, Inc.	76	88	703-266-1928
Communications Specialists	BC	3	800-854-0547	Radio Wholesale	79	101	800-53R-ADIO
Communications Data Services	86	116	800-441-0034	Ramsey Electronics	80	104	716-924-4560
Communications Instruments	87	118	800-288-8223	RCW Distributing	80	102	800-726-9015
Communications Associates	81	106	800-435-9313	Rocky Mountain Comms Inc.	85		303-526-5454
COMPUQUEST Inc.	81	105	800-722-2353	ROHN	39	35	309-697-4400
Comsearch	83	112	214-680-1000	Santa Fe Distributing	70	71	913-492-8288
COMTELCO Industries, Inc.	66	63	800-634-4622	Scala Electronic Corp.	49	43	503-779-6500
Control Signal Corp.	12	11	303-989-8000	Schlumberger Technologies	3	5	800-225-5765
Cushcraft/Signals Corp.	15	16	800-258-3860	Securitron Company	69	69	408-263-6434
Cushman/KNS Electronics	87	119	408-432-8100	Shinwa Communications of Am	28	25	800-627-4722
Cybersym Control Sys.	85	114	703-268-5400	Shure Brothers Inc.	53	46	800-25S-HURE
Datacom Inc.	40	36	217-222-0160	Sigtone, Inc.	62	56	800-525-8663
Data Signal Inc.	48	42	912-883-4703	Simrad Inc.	54	47	800-426-5565
Decibel Products, Inc.	36,37	31,32	214-631-0310	Sinclair Radio Laboratories	45	40	800-288-2763
Doppler Systems, Inc.	38	33	602-488-9755	Skyline Antenna Mgmt	83	111	203-684-4444
Dynatech Tactical Comms	56	49	603-880-4411	SMC Electro-Mount	66	64	800-527-1079
Eagle Wichita	63	57	316-942-5100	Softwright	86		303-329-6388
Freeman Engineering Assoc.	23	21	504-831-7785	Solar Electric Specialties	67	65	707-459-9496
General Communications	76	87	800-356-3200	Sonic Communications Inc.	71	75	603-878-1944
GLB Electronics	71	73	716-675-6740	Southern Computer Corp.	77	92	800-752-3571
Hark Electronic Systems Inc.	61	55	800-FOR-HARK	SS7 Summit	59	53	800-458-0479
Henry Radio	52	45	800-877-7979	Standard Communications	43	38	800-767-6695
Hutton Communications	64,65	60,62	800-442-3811	STI-CO Industries Inc.	30	27	716-662-2680
HY-Q International	75	85	606-283-5000	TAD Radio	58	51	509-326-1511
ICOM America	35	30	206-454-8155	Tait Electronics USA, Inc.	60	54	713-984-8684
IFR Systems, Inc.	27	24	316-522-4981	TEAC America, Inc.	55	48	213-726-0303
Industrial Comms & Elecs	82	109	617-585-9100	Transcrypt International Ltd.	5	6	402-435-4400
JaBRO Batteries Inc.	70	72	800-323-3779	Trylon Manufacturing Co. Ltd.	71	74	519-669-5421
JFW Industries Inc.	63	58	317-887-1340	VCP International Inc.	64,65	59,61	800-527-9366
Kern Pager Repair Inc.	86	117	800-844-KERN	Vega. A Mark IV Company	1	4	818-442-0782
Kyodo West Inc.	21	19	800-535-2082	Vocom Products Corp.	68	68	800-USA-MADE
Larsen Electronics	50-51	44	206-573-2722	WAVETEK	7	7	800-245-6356
Lindgren R.F. Enclosures Inc.	69	70	708-307-7200	W & W Associates	57	50	800-221-0732
Logotronix, Inc.	79	100	800-442-4887	Yaesu USA	IBC		213-404-2700
Magellen Systems Corp.	29	26	714-394-5000	Zetron Inc.	67	66	206-820-6363
Marktronics Corp.	24	22	800-845-1230				



Yaesu Didn't Invent Radio Communications We Just Made It Better

Whatever your needs and budget, Yaesu USA has the equipment with the most advanced technology for you. For instance, choose the Vertex series mobiles available in 4, 12/24 and 99 channel (superior signaling capabilities) configurations in low-band, VHF or UHF versions. Or select the only commercial dual-band (VHF/UHF) handheld—the FTH-2070, or the economical 6 channel FTH-2009/7009 handheld or the rugged 15 channel FTH-2008/7008 handheld.

To get the full story on Yaesu radio products, contact your nearest Authorized Yaesu USA Dealer or

- Yaesu USA call **310-404-2700**.
- Central and South America call **305-593-2500**.
- Canada, contact Omni Provincial Electronics at **416-841-6740**.

YAESU U.S.A.



A Page in Time.

Our PE-1000 Paging Encoder has carved a proud new chapter in simple, reliable, paging. No tools, software, or tomahawks are needed to program the user friendly features — it's done through the keyboard.

The PE-1000 is compatible with all two-tone sequential formats, and is also available in five-tone and RPC1. An internal memory, made up of standard Motorola and G.E. tone groups, provides 1000 calls. Non-standard tones as well as an optional 19 inch rack mount model are also available.

If you need to send just one call, scout our PE-2P Encoder. The PE-2P is designed to be installed inside the radio or other enclosure, and is programmable from a memory base of 32 tone frequencies. Both the PE-1000 and PE-2P Encoders are perfect matches for our programmable 1000 call SD-1000 Two-tone Sequential Decoder.

The PE-1000 isn't just a legend, it's ready for pronto one day delivery and is covered by our epic one year, no hassle warranty. Why not send that tired old encoder to the Happy Hunting Grounds with the wampum it takes for a few service calls.

PE-1000 Desktop Encoder	\$224.95
PE-1000RM Rack Mount	324.95
PE-2P Single Call Encoder	54.95
SD-1000 Decoder	59.95

(all prices are service station net)



**COMMUNICATIONS
SPECIALISTS, INC.**

426 W. Talt Ave., Orange, CA 92665-4296
Local (714) 998-3021 Fax (714) 974-3420
Entire USA 1-800-854-0547

Circle (3) on Fast Fact Card